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Practical Illumination Design Method and Data

Selection of Fixtures and Their Location Determined by Nature of Service to Be Rendered — Allowance Made for Depreciation of Efficiency — Best Results Obtained by Accurate Calculation

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With the keener appreciation of the value of artificial illumination has come, quite naturally, a demand for lighting systems which will meet requirements far more exacting than those that earlier systems were expected to satisfy. Not only are more foot-candles of illumination required, but refinement in illumination design has become necessary and considerations which were looked upon as relatively unimportant when lighting was judged by the old standards have taken on a new significance; the selection and spacing of lighting units, the coefficient of utilization, depreciation of the system, and similar fundamental factors which influence the result must be handled with more careful attention to the conditions and requirements of the individual installation. To take the several essential factors properly into account has appeared so complicated a task that many designers have adhered to rule-of-thumb methods which, while adequate in some cases, are likely to lead to unsatisfactory results when applied generally.

The method of design presented herewith will be found fully as simple as any of the common short-cuts, and it has the decided advantage that the technical considerations which are important as influencing the result, and which require the experienced judgment of the engineer, have been taken into account in the preparation of the charts and tables and therefore automatically receive due

Typical Example of Well-Designed System of General Illumination in a Woodworking Shop.

	Color Reflection Factor	Ceiling	Very Light (70%)			Fairly Light (50%)			Fairly Dark (30%)	
		Walls	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Dark (30%)	Very Dark (10%)
	Reflector Type	Room Index	Coefficients of Utilization							
1	Bowl Enameled Lamp	0.6	.34	.29	.24	.34	.29	.24	.28	.24
		0.8	.42	.38	.34	.42	.37	.33	.37	.33
		1.0	.46	.43	.39	.45	.42	.39	.42	.39
		1.25	.50	.47	.43	.49	.46	.43	.45	.42
		1.5	.53	.50	.46	.52	.49	.46	.48	.45
		2.0	.58	.55	.51	.57	.54	.51	.53	.51
		2.5	.62	.59	.56	.61	.58	.56	.58	.56
		3.0	.64	.61	.58	.63	.60	.58	.60	.58
		4.0	.67	.65	.63	.66	.64	.62	.63	.61
		5.0	.69	.67	.65	.67	.66	.64	.65	.63
2	Bowl Enameled Lamp	0.6	.32	.28	.25	.32	.28	.25	.27	.25
		0.8	.40	.36	.34	.39	.35	.33	.35	.33
		1.0	.43	.39	.37	.42	.39	.37	.39	.37
		1.25	.46	.43	.41	.45	.43	.41	.43	.41
		1.5	.48	.45	.43	.47	.45	.43	.45	.43
		2.0	.52	.50	.48	.51	.49	.47	.49	.47
		2.5	.56	.54	.52	.55	.53	.52	.53	.51
		3.0	.57	.56	.55	.56	.54	.52	.55	.52
		4.0	.60	.58	.56	.57	.56	.55	.57	.55
		5.0	.61	.59	.57	.60	.58	.57	.58	.56
3	Bowl Enameled Lamp	0.6	.28	.25	.22	.27	.24	.22	.23	.21
		0.8	.34	.31	.29	.33	.30	.28	.30	.28
		1.0	.38	.35	.33	.36	.34	.32	.33	.32
		1.25	.41	.38	.36	.39	.37	.35	.36	.35
		1.5	.43	.40	.38	.41	.39	.37	.38	.37
		2.0	.47	.44	.42	.45	.43	.41	.41	.40
		2.5	.50	.47	.45	.48	.46	.44	.44	.43
		3.0	.51	.49	.47	.49	.47	.46	.46	.45
		4.0	.53	.51	.50	.51	.49	.48	.48	.47
		5.0	.55	.53	.51	.52	.50	.49	.49	.48
4	Clear Lamp	0.6	.31	.26	.23	.30	.26	.23	.25	.23
		0.8	.38	.34	.31	.37	.33	.31	.33	.31
		1.0	.41	.38	.35	.41	.38	.35	.37	.35
		1.25	.44	.41	.38	.44	.41	.38	.40	.38
		1.5	.47	.44	.41	.46	.43	.41	.43	.41
		2.0	.51	.48	.45	.50	.47	.45	.47	.45
		2.5	.54	.51	.49	.53	.51	.49	.51	.48
		3.0	.56	.54	.51	.55	.53	.51	.53	.51
		4.0	.58	.56	.54	.57	.55	.54	.55	.53
		5.0	.60	.58	.56	.58	.57	.55	.56	.55
5	Bowl Enameled Lamp	0.6	.29	.26	.23	.29	.26	.23	.25	.23
		0.8	.35	.33	.31	.35	.32	.30	.32	.30
		1.0	.38	.36	.34	.38	.36	.34	.35	.34
		1.25	.41	.39	.37	.41	.39	.37	.38	.37
		1.5	.44	.41	.39	.43	.41	.39	.40	.39
		2.0	.47	.45	.43	.46	.44	.43	.43	.43
		2.5	.50	.48	.46	.49	.47	.46	.47	.46
		3.0	.51	.49	.47	.50	.48	.47	.47	.47
		4.0	.53	.51	.50	.52	.50	.49	.49	.49
		5.0	.54	.52	.51	.53	.51	.50	.50	.49
6	Alzak Lamp	0.6	.27	.23	.21	.26	.23	.21	.23	.21
		0.8	.32	.30	.28	.32	.29	.27	.29	.27
		1.0	.35	.33	.31	.35	.33	.31	.32	.31
		1.25	.38	.36	.34	.37	.35	.34	.35	.34
		1.5	.40	.38	.36	.39	.37	.36	.37	.36
		2.0	.43	.41	.39	.42	.41	.39	.40	.39
		2.5	.46	.44	.42	.45	.43	.42	.43	.42
		3.0	.47	.45	.43	.46	.44	.43	.44	.43
		4.0	.49	.47	.46	.48	.46	.45	.46	.45
		5.0	.50	.48	.47	.49	.47	.46	.47	.46
7	Clear Lamp	0.6	.26	.20	.16	.26	.19	.16	.19	.16
		0.8	.32	.26	.22	.32	.26	.22	.26	.22
		1.0	.36	.30	.26	.36	.30	.26	.30	.26
		1.25	.41	.35	.30	.39	.34	.30	.33	.30
		1.5	.44	.38	.33	.42	.37	.33	.36	.33
		2.0	.50	.44	.38	.48	.43	.38	.42	.42
		2.5	.54	.48	.42	.52	.47	.42	.46	.42
		3.0	.57	.51	.46	.55	.50	.45	.49	.45
		4.0	.62	.56	.51	.60	.54	.50	.53	.50
		5.0	.65	.60	.54	.62	.56	.53	.55	.53

	Color Reflection Factor	Ceiling	Very Light (70%)			Fairly Light (50%)			Fairly Dark (30%)	
		Walls	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Dark (30%)	Very Dark (10%)
	Reflector Type	Room Index	Coefficients of Utilization							
15	Diffusing Globe Light Opal	0.6	.18	.13	.10	.16	.12	.10	.10	.09
		0.8	.22	.17	.14	.20	.16	.13	.14	.12
		1.0	.26	.21	.18	.23	.19	.16	.17	.14
		1.25	.29	.24	.21	.26	.22	.19	.19	.16
		1.5	.32	.27	.23	.29	.24	.21	.22	.19
		2.0	.37	.32	.28	.32	.28	.25	.25	.22
		2.5	.40	.35	.31	.35	.31	.28	.28	.25
		3.0	.43	.38	.34	.38	.33	.30	.30	.27
		4.0	.47	.42	.38	.41	.37	.34	.33	.31
		5.0	.49	.45	.41	.43	.39	.36	.34	.33
16	One-Piece Opal Flattened Reflecting	0.6	.22	.17	.14	.20	.16	.13	.14	.12
		0.8	.27	.22	.19	.25	.21	.18	.19	.17
		1.0	.31	.26	.23	.28	.24	.21	.22	.19
		1.25	.35	.30	.26	.31	.27	.24	.25	.22
		1.5	.38	.33	.29	.34	.30	.27	.27	.24
		2.0	.42	.38	.33	.38	.34	.31	.31	.28
		2.5	.46	.41	.37	.41	.37	.34	.34	.31
		3.0	.49	.45	.40	.43	.39	.36	.36	.33
		4.0	.53	.48	.44	.47	.43	.40	.38	.36
		5.0	.55	.51	.47	.49	.45	.42	.40	.38
17	Diffusing Globe Large Metal Reflector	0.6	.22	.17	.14	.22	.17	.14	.17	.14
		0.8	.28	.23	.20	.27	.23	.19	.23	.19
		1.0	.31	.26	.23	.31	.26	.22	.26	.23
		1.25	.34	.30	.26	.33	.29	.26	.29	.26
		1.5	.36	.32	.29	.36	.32	.28	.31	.28
		2.0	.41	.37	.33	.40	.36	.33	.35	.32
		2.5	.43	.41	.37	.43	.40	.37	.39	.36
		3.0	.45	.43	.39	.45	.42	.39	.41	.39
		4.0	.50	.47	.43	.48	.45	.43	.44	.42
		5.0	.52	.49	.45	.50	.47	.44	.46	.44
18	Semi-Enclosing Metal Reflector	0.6	.22	.17	.13	.21	.16	.13	.15	.13
		0.8	.28	.22	.19	.26	.21	.18	.21	.18
		1.0	.31	.26	.23	.30	.25	.22	.24	.21
		1.25	.35	.30	.26	.34	.28	.25	.27	.24
		1.5	.38	.33	.28	.36	.31	.27	.30	.26
		2.0	.43	.38	.33	.40	.36	.32	.34	.30
		2.5	.46	.41	.37	.44	.39	.36	.37	.34
		3.0	.49	.44	.40	.46	.42	.38	.40	.37
		4.0	.54	.49	.44	.50	.45	.42	.43	.40
		5.0	.56	.51	.47	.52	.47	.45	.44	.43
19	Semi-Enclosing Compo Reflector	0.6	.24	.18	.14	.23	.18	.14	.17	.14
		0.8	.30	.24	.21	.29	.23	.20	.20	.20
		1.0	.33	.28	.25	.32	.27	.24	.24	.24
		1.25	.37	.32	.28	.35	.31	.28	.27	.27
		1.5	.39	.35	.31	.38	.34	.30	.32	.29
		2.0	.44	.40	.35	.42	.38	.34	.37	.34
		2.5	.48	.44	.39	.45	.42	.38	.41	.38
		3.0	.50	.46	.42	.48	.44	.41	.43	.40
		4.0	.55	.51	.47	.51	.49	.45	.46	.44
		5.0	.57	.53	.49	.54	.50	.47	.48	.46
20	Two-Piece Glass Opal Reflector and Enameled Bowl	0.6	.22	.17	.14	.21	.17	.14	.16	.14
		0.8	.27	.23	.20	.26	.22	.19	.20	.19
		1.0	.30	.26	.23	.29	.25	.22	.23	.22
		1.25	.33	.29	.26	.32	.28	.25	.26	.25
		1.5	.36	.32	.29	.35	.31	.28	.29	.27
		2.0	.41	.37	.33	.39	.35	.32	.34	.31
		2.5	.44	.40	.36	.42	.38	.35	.37	.35
		3.0	.46	.42	.38	.43	.40	.37	.39	.37
		4.0	.49	.45	.42	.47	.43	.41	.42	.40
		5.0	.51	.48	.45	.48	.45	.43	.43	.41
21	One-Piece Glass Enameled Reflector and Bowl	0.6	.22	.17	.14	.21	.16	.14	.15	.14
		0.8	.27	.23	.20	.26	.22	.19	.20	.18
		1.0	.30	.26	.23	.29	.25	.22	.23	.21
		1.25	.34	.30	.26	.32	.28	.25	.26	.24
		1.5	.37	.33	.29	.34	.30	.27	.28	.26
		2.0	.41	.37	.33	.38	.34	.31	.32	.30
		2.5	.44	.40	.36	.41	.38	.35	.35	.33
		3.0	.47	.43	.39	.43	.40	.37	.37	.35
		4.0	.51	.47	.43	.47	.44	.41	.41	.39
		5.0	.53	.49	.45	.48	.45	.42	.42	.40

	Color Reflection Factor	Ceiling	Very Light (70%)			Fairly Light (50%)			Fairly Dark (30%)	
		Walls	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Dark (30%)	Very Dark (10%)
	Reflector Type	Room Index	Coefficients of Utilization							
8	Light Density Opal	0.6	.26	.21	.17	.24	.19	.16	.18	.15
		0.8	.32	.27	.23	.30	.25	.22	.24	.21
		1.0	.36	.31	.27	.34	.29	.26	.28	.24
		1.25	.40	.35	.31	.37	.32	.29	.30	.27
		1.5	.44	.38	.34	.40	.35	.32	.32	.30
		2.0	.49	.44	.39	.45	.40	.37	.37	.34
		2.5	.53	.48	.44	.49	.44	.41	.40	.38
		3.0	.56	.51	.47	.51	.46	.43	.42	.40
		4.0	.60	.55	.51	.55	.50	.47	.46	.44
		5.0	.62	.58	.54	.57	.53	.50	.48	.46
9	Light Density Opal Bowl Enameled Lamp	0.6	.22	.17	.14	.20	.16	.13	.14	.12
		0.8	.27	.22	.19	.25	.21	.18	.19	.16
		1.0	.31	.26	.23	.28	.24	.21	.22	.19
		1.25	.35	.30	.26	.31	.27	.24	.24	.22
		1.5	.38	.33	.29	.34	.30	.26	.27	.24
		2.0	.43	.38	.34	.38	.34	.31	.30	.28
		2.5	.47	.42	.38	.42	.38	.34	.33	.31
		3.0	.49	.44	.40	.44	.40	.36	.36	.33
		4.0	.53	.49	.45	.48	.44	.41	.39	.37
		5.0	.56	.52	.48	.50	.46	.43	.41	.39
10	Clear Lamp	0.6	.32	.27	.23	.31	.26	.22	.25	.22
		0.8	.40	.35	.31	.38	.34	.31	.33	.30
		1.0	.44	.39	.36	.42	.38	.35	.37	.35
		1.25	.47	.43	.40	.46	.42	.39	.40	.38
		1.5	.51	.47	.43	.49	.45	.42	.43	.41
		2.0	.56	.52	.48	.54	.50	.47	.48	.46
		2.5	.60	.56	.53	.57	.54	.52	.52	.50
		3.0	.63	.59	.55	.60	.56	.54	.54	.52
		4.0	.66	.63	.60	.63	.60	.58	.58	.55
		5.0	.67	.65	.62	.65	.61	.59	.59	.57
11	Bowl Enameled Lamp	0.6	.29	.24	.20	.28	.23	.20	.22	.20
		0.8	.35	.31	.28	.34	.30	.27	.29	.27
		1.0	.39	.35	.32	.38	.34	.31	.33	.31
		1.25	.43	.39	.36	.41	.38	.35	.36	.34
		1.5	.46	.42	.38	.44	.40	.37	.38	.36
		2.0	.51	.47	.44	.48	.45	.42	.43	.41
		2.5	.55	.51	.48	.52	.49	.46	.47	.45
		3.0	.57	.54	.50	.54	.51	.48	.48	.46
		4.0	.60	.57	.54	.57	.54	.52	.51	.50
		5.0	.62	.59	.56	.58	.56	.53	.53	.52
12	Clear Lamp	0.6	.32	.27	.24	.31	.27	.24	.27	.24
		0.8	.39	.35	.32	.37	.35	.32	.35	.32
		1.0	.43	.39	.37	.42	.39	.36	.37	.37
		1.25	.46	.43	.40	.45	.42	.40	.40	.40
		1.5	.49	.46	.43	.48	.45	.43	.43	.43
		2.0	.53	.50	.48	.52	.50	.48	.48	.48
		2.5	.57	.54	.52	.56	.54	.52	.52	.52
		3.0	.58	.56	.54	.57	.55	.54	.54	.53
		4.0	.61	.59	.57	.60	.58	.56	.56	.55
		5.0	.63	.61	.58	.61	.59	.58	.58	.57
13	Bowl Enameled Lamp	0.6	.26	.22	.19	.25	.22	.19	.21	.19
		0.8	.32	.29	.26	.31	.28	.26	.28	.26
		1.0	.35	.32	.30	.34	.32	.30	.31	.30
		1.25	.38	.35	.33	.37	.35	.33	.34	.33
		1.5	.40	.38	.35	.39	.37	.35	.36	.35
		2.0	.43	.41	.39	.42	.40	.39	.40	.39
		2.5	.46	.44	.42	.45	.43	.42	.43	.42
		3.0	.47	.46	.44	.46	.45	.44	.44	.43
		4.0	.49	.48	.46	.48	.47	.46	.46	.45
		5.0	.50	.49	.47	.49	.48	.47	.47	.46
14	Prismatic Industrial Clear Lamp	0.6	.33	.26	.21	.31	.25	.21	.24	.20
		0.8	.41	.35	.30	.39	.33	.29	.32	.29
		1.0	.45	.40	.35	.43	.39	.34	.37	.33
		1.25	.50	.44	.39	.47	.42	.38	.40	.37
		1.5	.52	.48	.43	.50	.45	.42	.43	.40
		2.0	.58	.54	.49	.56	.51	.47	.49	.46
		2.5	.63	.59	.54	.60	.56	.53	.54	.51
		3.0	.66	.62	.58	.63	.59	.56	.56	.54
		4.0	.71	.67	.63	.67	.63	.61	.60	.58
		5.0	.73	.69	.66	.69	.65	.63	.62	.60

	Color Reflection Factor	Ceiling	Very Light (70%)			Fairly Light (50%)			Fairly Dark (30%)	
		Walls	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Light (50%)	Fairly Dark (30%)	Very Dark (10%)	Fairly Dark (30%)	Very Dark (10%)
	Reflector Type	Room Index	Coefficients of Utilization							
22	Light Opal	0.6	.18	.14	.11	.15	.12	.09	.09	.07
		0.8	.22	.18	.15	.19	.15	.12	.12	.10
		1.0	.26	.22	.18	.22	.18	.15	.14	.12
		1.25	.30	.25	.22	.25	.21	.18	.16	.14
		1.5	.33	.28	.24	.27	.23	.20	.18	.16
		2.0	.38	.33	.29	.31	.27	.24	.21	.19
		2.5	.41	.36	.32	.34	.30	.27	.24	.22
		3.0	.44	.39	.35	.36	.32	.29	.25	.23
		4.0	.49	.44	.40	.40	.36	.33	.28	.26
		5.0	.51	.46	.42	.42	.38	.35	.29	.28
23	Dense Opal for Light Opal and Bowl-enameled Lamps	0.6	.16	.13	.11	.12	.10	.08	.07	.06
		0.8	.20	.17	.15	.16	.13	.11	.09	.08
		1.0	.23	.20	.17	.18	.15	.13	.10	.09
		1.25	.27	.23	.20	.21	.18	.16	.12	.11
		1.5	.29	.26	.22	.23	.19	.17	.13	.12
		2.0	.33	.29	.26	.26	.22	.20	.15	.14
		2.5	.36	.32	.29	.28	.25	.23	.17	.16
		3.0	.39	.35	.32	.30	.27	.25	.18	.17
		4.0	.43	.39	.36	.32	.30	.28	.20	.19
		5.0	.45	.41	.38	.34	.32	.30	.22	.20
24	Enameled Metal Reflector Opal Glass Bottom	0.6	.18	.15	.13	.14	.12	.11	.09	.08
		0.8	.22	.19	.17	.18	.16	.14	.12	.11
		1.0	.25	.22	.20	.20	.18	.16	.14	.13
		1.25	.29	.25	.23	.23	.20	.19	.15	.15
		1.5	.31	.28	.25	.25	.22	.20	.17	.16
		2.0	.34	.31	.29	.28	.25	.23	.19	.18
		2.5	.37	.34	.32	.30	.28	.26	.21	.20
		3.0	.39	.36	.34	.31	.29	.27	.21	.20
		4.0	.43	.40	.38	.34	.32	.30	.23	.22
		5.0	.45	.42	.40	.36	.34	.32	.25	.23
25	Bowl-enameled Lamp	0.6	.16	.13	.11	.12	.10	.08	.07	.06
		0.8	.19	.16	.14	.15	.13	.11	.08	.08
		1.0	.22	.19	.17	.17	.15	.13	.10	.09
		1.25	.25	.22	.19	.20	.17	.15	.11	.10
		1.5	.27	.24	.21	.21	.18	.16	.12	.11
		2.0	.31	.28	.25	.24	.21	.19	.14	.13
		2.5	.34	.31	.28	.25	.23	.22	.15	.15
		3.0	.36	.33	.31	.27	.25	.23	.16	.15
		4.0	.40	.37	.34	.29	.27	.26	.18	.17
		5.0	.41	.38	.37	.31	.29	.28	.19	.18
26	Clear Top Enclosed Frosted Globe	0.6	.16	.12	.10	.13	.10	.08	.07	.06
		0.8	.20	.16	.13	.15	.12	.11	.08	.08
		1.0	.23	.19	.16	.17	.15	.13	.10	.09
		1.25	.26	.22	.19	.20	.17	.15	.12	.10
		1.5	.29	.25	.21	.22	.18	.17	.13	.12
		2.0	.32	.28	.25	.25	.21	.20	.14	.13
		2.5	.36	.31	.28	.27	.24	.22	.15	.15
		3.0	.38	.34	.31	.29	.26	.25	.16	.15
		4.0	.42	.38	.35	.32	.29	.27	.18	.17
		5.0	.44	.40	.37	.34	.31	.29	.19	.18
27	Mirrored—Indirect	0.6	.15	.12	.10	.11	.09	.07	.05	.04
		0.8	.18	.15	.13	.13	.11	.09	.07	.06
		1.0	.22	.19	.16	.15	.13	.11	.08	.07
		1.25	.25	.22	.19	.18	.15	.13	.09	.08
		1.5	.27	.24	.21	.20	.17	.15	.10	.09
		2.0	.30	.27	.25	.22	.19	.17	.11	.10
		2.5	.34	.31	.28	.24	.22	.20	.13	.12
		3.0	.36	.33	.30	.25	.24	.22	.14	.13
		4.0	.40	.37	.34	.28	.26	.24	.15	.14
		5.0	.42	.39	.37	.30	.28	.26	.17	.15
28	Enameled Metal Indirect	0.6	.14	.11	.10	.10	.08	.07	.04	.04
		0.8	.17	.14	.13	.13	.10	.09	.06	.05
		1.0	.20	.17	.15	.14	.12	.10	.07	.06
		1.25	.23	.20	.17	.17	.14	.13	.08	.07
		1.5	.25	.22	.19	.18	.15	.14	.09	.08
		2.0	.28	.25	.23	.21	.18	.16	.10	.10
		2.5	.31	.28	.26	.22	.20	.18	.12	.11
		3.0	.33	.30	.28	.24	.22	.20	.13	.12
		4.0	.37	.34	.32	.26	.24	.22	.14	.13
		5.0	.39	.36	.34	.28	.26	.24	.15	.14

A GUIDE TO THE SELECTION OF REFLECTING EQUIPMENT

	LIGHTING UNIT		EFFICIENCY (Based upon: Illumination on Horizontal; Illumination on Vertical)	FAVORABLE APPEARANCE OF LIGHTED ROOM	DIRECT GLARE	REFLECTED GLARE	SHADOWS	MAINTENANCE
	DIRECT LIGHTING PORCELAIN ENAMEL REFLECTORS							
1			A+	B+	C+	C	D	C+	A+
2			A−	B	B	B+	B	B+	A−
3			B	C+	A−	A−	B	B+	B
4			B+	B−	C	C+	D	C	A
5			B	C+	C	B	C+	C+	B+
6			B	C+	C+	C+	D	C	B+
7			B	B	C	D	D	C	A+
	DIRECT LIGHTING OPEN GLASS REFLECTORS							
8			B+	B	B+	C+	D	B−	B
9			B	B−	A−	B−	B−	B+	B−
10			A+	B+	B+	B	D	C+	A−
11			B+	B−	A−	B+	B−	B	B
12			A	B	C	C+	D	C	A−
13			B	C+	C	B−	C	C+	B−
14			A+	A−	B+	C+	D	C+	B−

A GUIDE TO THE SELECTION OF REFLECTING EQUIPMENT

	LIGHTING UNIT		EFFICIENCY (Based upon: Illumination on Horizontal; Illumination on Vertical)	FAVORABLE APPEARANCE OF LIGHTED ROOM	DIRECT GLARE	REFLECTED GLARE	SHADOWS	MAINTENANCE
	DIRECT LIGHTING HOLOPHANE AND SEMI-INCLOSING UNITS							
15			B−	B−	A	B−	B	B+	B+
16			B	B	A	B	B	B+	A−
17			B	B	B+	B	B	B+	B+
18			B	B	A	B	B	B+	B−
19			B	B	A	A	A−	A−	C+
20			B	B	A	B+	B+	A−	B
21			B	B	A	B+	B+	A−	A−
	SEMI-INDIRECT AND INDIRECT LIGHTING UNITS							
22			B−	C+	A	B+	B+	A−	C
23			C+	C	A	A+	A	A+	C
24			B−	C	A	A	B+	B+	C
25			C+	C	A	A+	A	A	C
26			C+	C	A	A+	A	A	B
27			C+	C	B+	A+	A	A+	C
28			C	C	B+	A+	A	A+	C

allowance for the lighting design. The data apply in interiors where standard types of reflecting equipment are used to obtain general lighting of substantially uniform intensity. There are, of course, certain problems which call for special distributions of light from special types of equipment as, for example, show-window lighting, train lighting and photographic-studio lighting.

SPACING AND MOUNTING HEIGHT FOR DIRECT LIGHTING UNITS, INCLUDING SEMI-INCLOSING AND TOTALLY INCLOSING UNITS NO. 1 TO NO. 21.

Mounting height of unit. Above plane of work. (H)	Above floor. (F)	Permissible distance between outlets. (D)	Permissible distance between outlets and sidewalls. In usual locations where aisles and storage are next to wall. (W)	In offices or where work benches are next to wall. (W)
4	6½	6	3	2
5	7½	7½	3½	2½
6	8½	9	4½	3
7	9½	10½	5	3½
8	10½	12	6	4
9	11½	13½	6½	4½
10	12½	15	7½	5
11	13½	16½	8	5½
12	14½	18	9	6
13	15½	19½	9½	6½
14	16½	21	10½	7
15	17½	22½	11	7½
16	18½	24	12	8
18	20½	27	13½	9
20	22½	30	15	10
22	24½	33	16½	11
24	26½	36	18	12
27	29½	40½	20	13½
30	32½	45	22½	15
35	37½	52½	26	17½
40	42½	60	30	20

Four Essentials to Be Determined in Design Problems.

There are four separate things that must be fixed to complete a specific design of illumination for any given case. First, the foot-candles of illumination desired must be decided upon. In making a proper determination of this important and basic factor certain points such as location, advertising value, and nature of work to be done in the lighted space, must be taken into consideration. Next the type of lighting unit may be selected. The selection of the unit should be based on efficiency, glare, appearance, shadows and maintenance considerations. After these two points have been settled the location of outlets and mounting heights of the various units may be determined. Then it will remain only to determine the proper size and type of lamps to be installed. In the selection of lamp sizes the questions of area lighted per unit, intensity of illumination, depreciation factor and coefficient of utilization are all involved.

The following definitions are given as an interpretation of various terms used in describing design procedure:

Lumen.—The lumen is the unit of light flux quantity. The number of lumens required to light a given surface is proportional to the illumination in foot-candles and to the area of the surface in square feet.

Foot-Candle.—The degree to which a surface is illuminated is measured in foot-candles. One lumen will light a surface of 1 sq. ft. to an average intensity of 1 foot-candle.

Coefficient of Utilization (percentage of lumens effective).—The proportion of the lumens generated by the lamps which reaches the plane of work is known as the "Coefficient of Utilization." It is dependent upon the type of diffusing and reflecting equipment, color of walls and ceiling and also the proportions of the room; that is, the size and shape of the room and the height of the light

Table Showing Present Standards of Illumination for Various Service

	Foot-candles—Recommended.	Foot-candles—Under some conditions.
Auditorium, church	3	2- 4
School—Class room, study room, library	8	5-10
Store—		
Show window	10-70	....
First floor department, shop on bright street corners	10	6-12
Other clothing, dry goods, haberdashery, millinery, jewelry, etc.	8	5-10
Other drug, grocery, meat, bakery, book, florist, furniture, lunch room, confectionery, etc.	6	4-8
Office—		
Private, general	10	6-12
Drafting room	15	10-20
Industrial—		
Aisles, stairways, passageways and corridors	2	1- 2
Assembling—		
Rough	5	3- 6
Fine	10	6-12
Extra fine	10-50	....
Bakeries	8	5-10
Boilers, Engine Rooms and Power Houses—		
Boilers, coal and ash handling, storage battery rooms	3	2- 4
Auxiliary equipment, oil switches and transformers	5	3- 6
Switchboards, engines, generators, blowers and compressors	6	4- 8
Candy making	8	5-10
Canning and preserving	8	5-10
Chemical Works—		
Hand furnaces, boiling tanks, stationary driers, stationary or gravity crystallizing	3	2- 4
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizing, bleaching	4	3- 6
Clay Products and Cements—		
Molding, pressing, cleaning and trimming	5	3- 6
Coloring and glazing	10	6-12
Cloth Products—		
Light goods	10	6-12
Dark goods	15	10-20
Electric Manufacturing—		
Storage battery, molding of grids	6	4- 8
Coil and armature winding, mica working, insulating processes	10	6-12
Elevator—freight and passanger	5	3- 6
Forge Shops and Welding—		
Rough forging	6	4- 8
Fine forging and welding	10	6-12
Foundries—		
Charging floor, tumbling, cleaning, pouring and shaking out	5	3- 6
Rough molding and core making	6	4- 8
Fine molding and core making	10	6-12
Glass Works—		
Mix and furnace rooms, casting and Lehr	5	3- 6
Fine grinding, polishing, beveling, inspecting, etching and decorating	10	6-12
Glass cutting (cut glass), inspecting fine	10-50	. . .
Glove Manufacturing—		
Dark Goods:		
Cutting, pressing, knitting	10	6-12
Sorting, stitching, trimming and inspecting	10-50	....
Hat Manufacturing—		
Dyeing, Stiffening, Braiding, Cleaning and Refining:		
Light	6	4- 8
Dark	10	6-12
Forming, Sizing, Pouncing, Flanging, Finishing and Ironing:		
Dark	10	6-12
Sewing:		
Light	10	6-12
Ice Making—		
Engine and compressor room	6	4- 8
Inspecting—		
Rough	6	4- 8
Medium	10	6-12
Extra fine	10-50	....
Jewelry and watch manufacturing	10-50	....
Laundries and dry cleaning	8	5-10
Leather Manufacturing—		
Vats	3	2- 4
Cleaning, tanning and stretching	4	3- 6
Cutting, fleshing and stuffing	6	4- 8
Finishing and scarfing	10	6-12
Leather Working—		
Pressing and Winding:		
Light	8	5-10
Dark	10	6-12
Grading, Matching, Cutting, Scarfing and Sewing:		
Light	10	6-12
Dark	10-50	....
Locker rooms	4	2- 4
Machine Shops—		
Rough bench and machine work	6	4- 8
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing	12	8-16
Extra fine bench and machine work, grinding (fine work)	10-50	....
Meat Packing—		
Slaughtering	5	3- 6
Cleaning, cutting, cooking, grinding, canning, packing	8	5-10
Milling and Grain Foods—		
Cleaning, grinding or rolling	5	3- 6
Baking or roasting	8	5-10
Paint manufacturing	6	4- 8
Paint Shops—		
Dipping, spraying, firing	5	3- 6
Fine hand painting and finishing	10	6-12
Extra fine hand painting and finishing (automobile bodies, piano cases, etc.)	15	10-50
Paper Box Manufacturing—		
Light	6	4- 8
Dark	8	5-10
Paper Manufacturing—		
Beaters, machine and grinding	4	3- 6
Calendering	6	4- 8
Finishing, cutting and trimming	8	6-12
Plating	5	3- 6
Polishing and burnishing	8	5-10
Printing Industries—		
Matrixing and casting, miscellaneous machines, presses	8	5-10
Linotype, monotype, typesetting, imposing stone, engraving	10-50	....
Receiving and shipping	4	3- 6
Rubber Manufacturing and Products—		
Calenders, compounding mills, fabric preparation, stock cutting, tubing machines, solid tire operations, mechanical goods building, vulcanizing	8	5-10
Bead building, pneumatic tire building and finishing, inner tube operation, mechanical goods trimming, treading	10	6-12
Sheet Metal Works—		
Miscellaneous machines, ordinary bench work	8	5-10
Punches, presses, shears, stamps, welders, spinning, fine bench work	10	6-12
Shoe Manufacturing—		
Hand turning, miscellaneous bench and machine work	8	5-10
Inspecting and sorting raw material, cutting, lasting and welding (light)	10	6-12
Inspecting and sorting raw material, cutting, stitching (dark)	10-50	....
Soap Manufacturing—		
Kettle houses, cutting, soap chip and powder	5	3- 6
Stamping, wrapping and packing, filling and packing soap powder	6	4- 8
Steel and Iron Mills, Bar, Sheet and Wire Products—		
Soaking pits and reheating furnaces	2	1- 2
Charging and casting floors	3	2- 4
Muck and heavy rolling, shearing, rough by gauge, pickling and cleaning	4	3- 6
Automatic machines, rod, light and cold rolling, wire drawing, shearing, fine by line	6	4- 8
Store and Stock Rooms—		
Rough	3	2- 4
Medium	6	4- 8
Fine	8	5-10
Structural steel fabrication	6	4- 8
Textile Mills—		
(Cotton)		
Opening and lapping, carding, drawing, frame, roving, dyeing,	4	3- 6
Spooling, spinning, drawing in, warping, weaving, quilling, inspecting, knitting, slashing	8	5-10
(Woolen)		
Carding, picking, washing and combing	4	3- 6
Twisting and dyeing	6	4- 8
Drawing in, warping:		
Light goods	6	4- 8
Dark goods	10	6-12
Weaving:		
Light goods	8	5-10
Dark goods	12	8-16
Knitting machines	10	6-12
Tobacco products	8	5-10
Toilet and wash rooms	4	3- 6
Wood Working—		
Rough sawing and bench work	5	3- 6
Sizing, planing, rough sanding, medium machine and bench work, gluing, veneering, cooperage	8	5-10
Fine and bench and machine working, fine sanding and finishing	10	6-12

Direct Lighting-SOURCES 5 FEET ABOVE WORK PLANE

ROOM WIDTH	ROOM LENGTH—FEET																			
	10	12	14	16	18	20	24	30	35	40	50	60	70	80	100	120	140	170	200
8	0.8	0.8	1.0	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
10	1.0	1.0	1.0	1.25	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
12	1.0	1.25	1.25	1.25	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
14	1.0	1.25	1.5	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
16	1.25	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
18	1.25	1.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
20	1.25	1.5	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
24	1.25	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
30	1.5	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35	1.5	1.5	2.0	2.0	2.5	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
40	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
50	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
60	2.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
70	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
80	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
100	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
120	1.5	2.0	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Semi and Indirect Lighting-CEILING 7½ FEET ABOVE WORK PLANE

Direct Lighting-SOURCES 10 FEET ABOVE WORK PLANE

ROOM WIDTH	ROOM LENGTH—FEET																			
	10	12	14	16	18	20	24	30	35	40	50	60	70	80	100	120	140	170	200
8		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0
10	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0
12	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.25	1.25	1.25	1.25
14	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5
16	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5
18	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5
20	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
24	0.6	0.8	0.8	0.8	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0
30	0.6	0.8	0.8	1.0	1.0	1.25	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
35	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.5	1.5	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5
40	0.8	0.8	1.0	1.0	1.25	1.25	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
50	0.8	1.0	1.0	1.25	1.25	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0
60	0.8	1.0	1.25	1.25	1.25	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
70	1.0	1.0	1.25	1.25	1.5	1.5	1.5	2.0	2.0	2.5	3.0	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0
80	1.0	1.25	1.25	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
100	1.0	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0
120	1.0	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	4.0	4.0	5.0	5.0	5.0	5.0	5.0

Semi and Indirect Lighting-CEILING 15 FEET ABOVE WORK PLANE

Direct Lighting-SOURCES 20 FEET ABOVE WORK PLANE

ROOM WIDTH	ROOM LENGTH—FEET																			
	10	12	14	16	18	20	24	30	35	40	50	60	70	80	100	120	140	170	200
8																			
10										0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	
12										0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8
14										0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0
16								0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0
18							0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0
20						0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	1.0	1.0	1.0
24					0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25
30				0.6	0.6	0.6	0.6	0.8	0.8	1.0	1.0	1.0	1.0	1.0	1.25	1.25	1.25	1.25	1.5
35		0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5
40	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5
50	0.6	0.6	0.6	0.6	0.6	0.6	0.8	1.0	1.0	1.0	1.25	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.0
60	0.6	0.6	0.6	0.6	0.6	0.6	0.8	1.0	1.0	1.25	1.25	1.5	1.5	1.5	1.5	2.0	2.0	2.0	2.0
70	0.6	0.6	0.6	0.6	0.6	0.8	0.8	1.0	1.0	1.25	1.5	1.5	1.5	2.0	2.0	2.0	2.0	2.5	2.5
80	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.25	1.25	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5	2.5
100	0.6	0.6	0.8	0.8	0.8	0.8	1.0	1.0	1.25	1.5	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0
120	0.6	0.6	0.8	0.8	0.8	0.8	1.0	1.25	1.25	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	3.0

Semi and Indirect Lighting-CEILING 30 FEET ABOVE WORK PLANE

Direct Lighting-SOURCES 40 FEET ABOVE WORK PLANE

ROOM WIDTH	ROOM LENGTH—FEET																			
	10	12	14	16	18	20	24	30	35	40	50	60	70	80	100	120	140	170	200
8																			
10																			
12																			
14																			
16																			
18																			
20														0.6	0.6	0.6	0.6	0.6	0.6
24													0.6	0.6	0.6	0.6	0.6	0.6	0.6
30												0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8
35											0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8
40										0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8
50									0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	0.8	0.8	1.0
60								0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.0	1.0
70							0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.0	1.25	1.25
80						0.6	0.6	0.6	0.6	0.6	0.8	0.8	0.8	1.0	1.0	1.25	1.25	1.25	1.5
100						0.6	0.6	0.6	0.6	0.6	0.8	1.0	1.0	1.0	1.25	1.25	1.5	1.5	1.5
120						0.6	0.6	0.6	0.6	0.6	0.8	1.0	1.0	1.25	1.25	1.5	1.5	1.5	1.5

Semi and Indirect Lighting-CEILING 60 FEET ABOVE WORK PLANE

Tables Showing "Room Index" for Rooms of Various Sizes and for Different Heights of Lighting Unit.

source above the plane of work. These room proportions are classified in this article by **room index** tables. The plane of work, unless otherwise specified, is ordinarily considered to be horizontal and 2.5 ft. above the floor.

Depreciation Factor.—This represents a safety factor which provides added initial illumination sufficient to compensate for aging of the lamps and the falling off in reflecting efficiency of the reflectors, walls and ceilings due to deterioration and the collection of dust and dirt. A depreciation factor should always be applied to the recommendations of foot-candles of illumination, since these are always stated in terms of average service or sustained illumination.

Selection of Lighting Unit and Intensity of Illumination.

The desirable intensity of illumination varies rather widely, depending on the conditions in any particular installation, such as the accuracy of the operation and fineness of detail to be observed, the color of goods worked on or handled and, in the case of stores, the advertising value resulting from the attractiveness of a well lighted interior. The foot-candle values here recommended are the minimum to be adhered to if fully satisfactory lighting is to be assured and under particular conditions considerably higher illumination is often desirable.

Selection of the type of lighting unit depends not only upon the requirements of the work, but in some cases upon the construction of the room and the color of ceiling and walls. It is important to specify the type of lamp to be used since, for example, bowl-enameled lamps used in open reflectors, such as RLM standard domes, form a much superior lighting unit from the standpoint of glare, reflected glare and shadows than clear lamp units of the same type. In general, clear type lamps should not be used in open reflectors where the mounting height is less than 20 ft.

Factors other than those herein listed may enter into the choice of the lighting unit in certain instances. For example, in stores, offices and other public installations, decorative effect is often an important item. The charts entitled "A guide to the selection of reflecting equipment," rate the various types of units comparatively to serve as a basis for judgment of the adaptability of a unit for a particular class of installation.

(To be continued.)

TABLE SHOWING PRESENT LUMEN OUTPUT OF TUNGSTEN LAMPS.

110-125 volt

Size of lamp in watts	Standard lighting service Type C	Type B	Daylight	220-250 volt Type C	Type B
10.....	.....	75	.....*	.....	...
15.....	.....	125	....	.....	...
25.....	.....	226	....	.....	191
40.....	.....	372	....	.....	...
50.....	450*	480	....	.....	442
60.....	.....	575	....	.....	...
75.....	865	...	600	.....	...
100.....	1260	...	875	995	945
150.....	2040	...	1400	.....	...
200.....	3100	...	2000	2520	...
300.....	4840	...	3360	4100	...
500.....	8750	...	5600	7850	...
750.....	13900	...	....	.....	...
1000.....	19300	...	....	17500	...

*White.

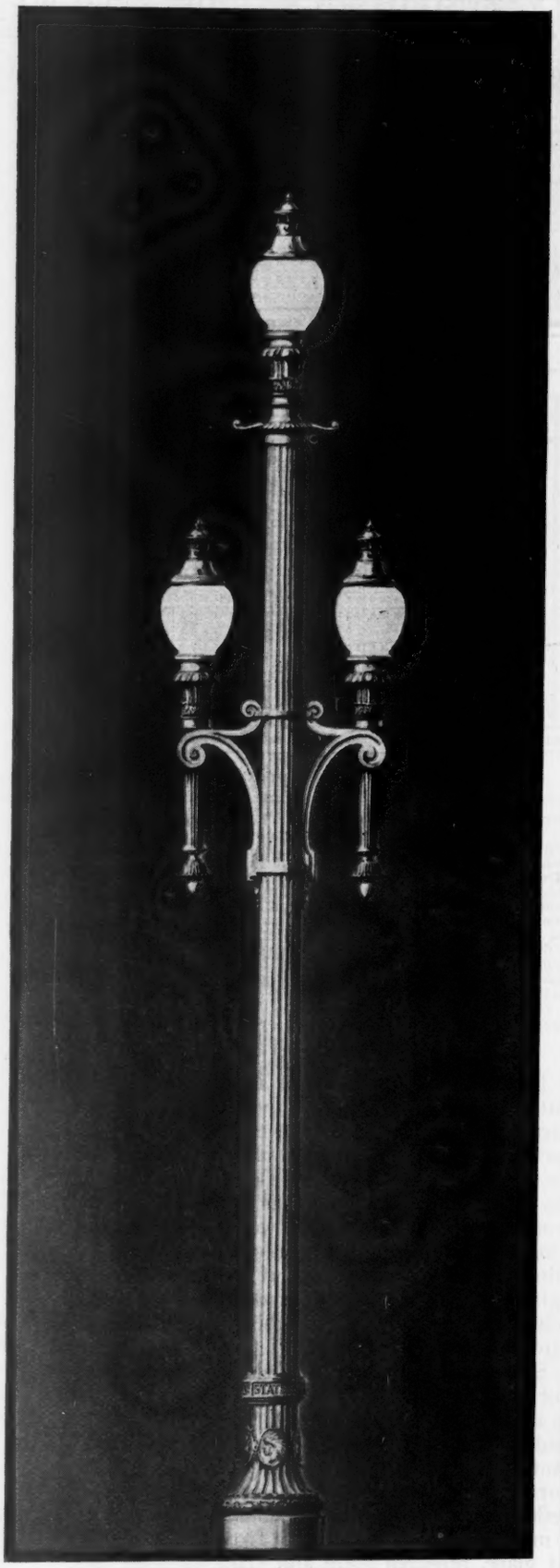
The combined output of the Hartford Electric Light Co. and its subsidiary organization, the Connecticut Power Co., in 1920, was 103,000,000 kw-hrs., an increase of 10,000,000 kw-hrs. over the previous year. The greatest burden during the period was the increased cost of fuel, which has averaged 30% above pre-war figures.

EXTEND "WHITE WAY" SYSTEM IN SALT LAKE.

Addition Being Made After Experience Demonstrates Utility and Value of Original Installation.

A contract has just been given to the Utah Power & Light Co. by Salt Lake City for an extensive addition to the city's ornamental street-lighting system which, it is said, when executed, will give Salt Lake the distinction of being the best lighted city of its size in the world. The contract calls for 112 standards each carrying three 6.6-ampere General Electric Co. ornamental luminous arc lamps. The Union Metal Manufacturing Co., Canton, O., will furnish the standards which will envelop the present trolley poles and carry two lamps below the trolley wire and one above. The total cost of the installation will be approximately $100,000.

Of special significance is the fact that the extension to the lighting system was brought about directly as a result of the success attending the first installation. Salt Lake City will now have 182 lighting standards with 546 luminous arc lamps, giving a total candle power of 819,000 on less than 2 mi. of streets, which is approximately 90 candle power per foot of street lighted. The second installation is interesting proof that after 3 years' trial of the original intensive "white way" the business men of Salt Lake have decided that it is a good investment and worthy of extension.



Ornamental Trolley Pole and "White Way" Lighting Equipment for Salt Lake City.

Automatic Hydroelectric Plants for Power and Lighting

Various Types of Control and Regulating Equipment Available for Use with Stations Operating Without Individual Attendants —Power-Factor Problems Influence Type of Machine Selected

By T. A. E. BELT

Lighting Engineering Department, General Electric Co., Schenectady, N. Y.

In the economy of the nation water power is the most desirable form of power since it does not use up any of our natural resources. No matter how much we take out of our rivers and streams, next year and the years after they flow just the same. But there are only a few very great water powers like Niagara and the power of the Mississippi at the Keokuk dam, most of the hydraulic powers being much smaller. Furthermore, while most of the big powers have been developed there are many small powers still undeveloped. However, there is a limit in size below which it is not economical to develop such power by the common methods, due to the cost of operation. But with the increasing development of electrical engineering this lower limit has been rather extended. While a small station which cannot afford high class engineers for its control and operation may have been fairly successful when it was an isolated station and any trouble, therefore, only local, now, when tied into the large distribution systems which cover the country, a much higher safety factor of operation is necessary since any serious trouble may involve the entire system. But the safety and reliability of a station is limited by the capacity of the men who direct and control its operation. Therefore, aside from the economy resulting from the saving of the cost of attendance, reliability of operation makes it preferable to control and operate such small stations at a distance from a large station which can afford the quality of attendance giving the assurance of first-class operation. And, finally, with the present-day development of electrical engineering it is possible to make the operation of the small station entirely automatic and thereby take its control out of the hands of the rather indifferent class of attendants economically available for such stations and give it the safety and reliability corresponding to the skill of the high-class engineers who control its operation—that is, the designing engineers who have devised and built its automatic control. Thus the automatic hydroelectric station is not merely an advance in economy which makes the operation of small stations possible, but it is an equal advance in the safety and reliability of the operation of these stations and therewith, of the systems into which these stations connect.—DR. C. P. STEINMETZ.

At present the greatest field for automatic hydroelectric generating stations is that of the medium-sized and small plants, auxiliary to a larger system, for in such plants no operators need to be stationed. A periodic inspection by a line patrolman or any other qualified person is the only attendance required. In many places throughout the country are small water-power sites which may be located near each other on the same stream. It is not economical in many cases to use the total head of water of the several sites for the development of one large plant. To develop each site independently, although a comparatively small initial investment is involved, may not be an economical operating proposition if operators are maintained, but by the installation of automatic-control equipment which eliminates the operating force each independent site can be developed into an economical plant. The management of a 20,000 or 30,000-kv-a. system is usually ready to welcome the addition of a continuous 500-kw. load. Conversely, a continuous supply of 500 kw. delivered into the system at a low unit cost should likewise be welcomed.

Remotely Controlled Automatic Hydroelectric Generating Station.

The simplified wiring digram, Fig. 1, shows the arrangement for a semi-automatic plant controlled from some other station by means of a 3-phase power line and two additional conductors for controlling the waterwheel gate opening. The operator first closes the control switch, which causes the waterwheel gate to open, thus starting the generator. The field of the generator is connected to the armature of the direct-connected or

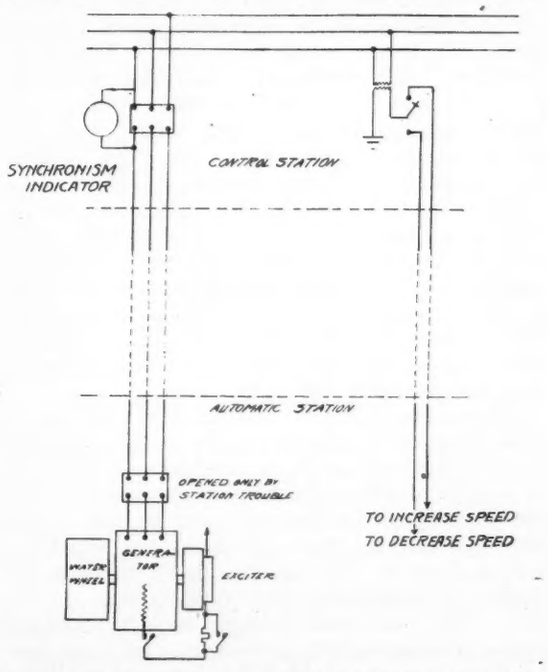


Fig. 1.—Control System for Remotely Controlling Automatic Station, Requiring Pilot Wires.

belted exciter by the closing of the contactor in the main field circuit, and the generator builds up the voltage as the speed increases. The operator, having a synchronism indicator connected across the oil circuit-breaker in the hand-controlled sta-

tion, adjusts the speed and synchronizes the generator as if it were a machine in the same plant. After the generator is synchronized the load, which is under the operator's control, may be adjusted to any desired amount. In order to have a lower value of excitation for synchronizing than that required under full-load operation resistance

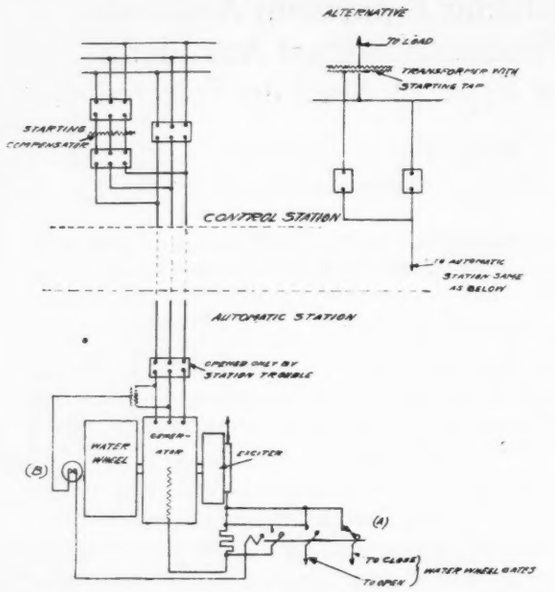


Fig. 2.—Control System Without Pilot Wires for Automatic Station.

is inserted in the generator field circuit. This resistance is automatically short-circuited by a contactor when the two stations are connected.

The automatic station when connected to the system operates at constant excitation, which is practical because it is in parallel with another station where the voltage is under the control of operators. If the remotely controlled generator is over-excited for the load carried a leading current is supplied to the system, which improves the power-factor provided that the system load demands a lagging current. This control scheme may be used when the waterwheel wicket gates are operated by a remotely controlled governor or by an electrically operated valve which controls a hydraulically operated piston connected to the wicket gates. If desired, a motor-operated wicket gate may be used which makes a third control line necessary if 3-phase power is used for operating the motor.

Where the distance between the stations is great the cost of conductors for waterwheel gate control may amount to a considerable sum, but by a slightly different scheme these control wires can be omitted, leaving only the 3-phase power line between stations. Thus, in the simplified wiring diagram, Fig. 2, the operator starts the station by impressing fractional voltage on the line. The fractional voltage may be obtained either from a starting compensator or from taps on transformers provided that they are available.

In the remotely controlled station the generator is equipped with an amortisseur winding and is started as an induction motor. As the generator comes to synchronism the exciter builds up its voltage and excites the generator field, thus pulling the generator into step. Ammeters in the control station indicate when the generator pulls into step, and the operator then opens the fractional-voltage supply and closes the line oil circuit-breaker, thus applying full voltage to the remotely controlled generator. The closing of the oil circuit-breaker causes contactor *A* to close, which applies full excitation to the generator and opens the waterwheel gate to the full-gate position. The gate motor is operated by direct current supplied from the exciter.

To close down the remotely controlled generator the operator opens the oil circuit-breaker in the main station. The generator then speeds up and the centrifugal switch *B* breaks the coil circuit of the contactor *A*, which drops out and completes a circuit to close the gate. This contactor is arranged to insert resistance in the exciter-field circuit and so prevents the generator voltage from rising above normal value.

Features of Design and Operation of the Entirely Automatic Station.

Entirely automatic stations differ from remotely controlled stations in that the power line does not necessarily pass through a manually operated plant, but may be tapped directly into the transmission network. Referring to Fig. 3, the contacts of the float switch close when the water level in the forebay rises to a predetermined level, thus energizing a relay and causing the contactor for the gate-motor circuit to close. The closing of this contactor applies voltage to the polyphase gate motor which is connected to the waterwheel wicket gate through proper gearing.

The motor opens the gate approximately 20%, thus admitting sufficient water to start the waterwheel. At 20% gate opening the gate-motor contactor is dropped out by the breaking of its coil circuit, which is opened by one of the drum-controlled segments, the drum controller being driven through suitable gearing by the gate motor. The wicket gate stays in the partially open position until the waterwheel comes to nearly synchronous speed when the contacts of centrifugal switch *A*, driven from the shaft of the generator, close, thus bridging the break in the drum-controller segment and causing the gate motor to continue

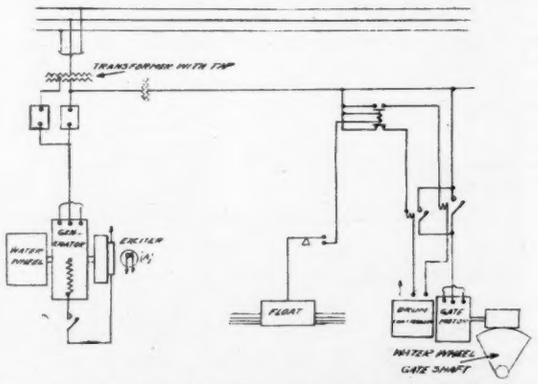


Fig. 3.—Control System for an Entirely Automatic Generating Station.

to open the gate. The proper segment on the drum controller then causes the fractional-voltage circuit-breaker to close, connecting the generator to the fractional-voltage transformer taps. A drum-controller segment then making contact causes the generator-field contactor to close and so excites the generator, pulling it into step. By

means of controller segments operating on the proper control circuits the fractional-voltage oil circuit-breaker is tripped and the main-line oil circuit-breaker is closed. The generator is thus properly connected to the bus and operates at a load corresponding to the head of water available. If the level of the water in the forebay falls to a predetermined minimum the station is automtically taken out of service.

Where the head of water is constant and full kilowatt output from the generator is desired at all times, the motor-operated wicket gate may be dispensed with and the waterwheel provided with fixed wicket gates. A motor-operated or hydraulically operated valve can then be used for starting and stopping the station. The general scheme of an automatic control which may be used to advantage in many installations, and which can be slightly modified in details to meet the requirements of any individual plant, is illustrated in Fig. 4. The scheme involves the use of a master starting element shown in the diagram as a float switch, but which may be either a frequency-controlled device, a pressure governor, a relay energized over pilot wires, or any device which will close the circuit of a solenoid or other starting device to admit water to the waterwheel.

When the waterwheel comes to approximately 90% of synchronous speed the contacts of the centrifugal switch close, which completes the circuit through an auxiliary switch attached to the gate mechanism to close the main-line and generator-field contactors. The closing of the generator-field contactor also completes the field circuit of the exciter. Owing to the time lag in the building up of the fields the generator is excited an instant after the closing of the main line contactor, which pulls the generator into step with a minimum disturbance to the system. The generator thus properly connected to the line will carry its share of the system load when a governor is used, but when the gates are motor- or hydraulically operated the load will depend upon the degree of the gate opening.

When the master element opens the circuit of the starting device, or when the protective devices wired in series with the contacts of the master element operate, the station will close down. In closing down, the load on the generator is first reduced and then the main-line and field contactors are opened by an auxiliary switch which is operated from the gate mechanism.

Protective Devices Required for Safety of Equipment.

In any automatic generating-station installation certain protective devices are necessary, but for small stations the degree of protection need not be so complete as for larger stations where a number of large machines are involved. Protection should be provided in any installation against hot bearings, overloads and overspeed. If the bearing temperature of a generator, waterwheel or exciter exceeds a predetermind maximum value a thermostatic relay may be used to open the master-control circuit and so close down the machine in trouble and prevent its restarting until an inspection of the overheated bearing is made.

With a constant head of water and a constant waterwheel-gate opening no continued overload can be imposed upon the generator. A waterwheel, properly chosen for the capacity of the generator which it is to drive, will impose a severe overload upon the generator only with a radical increase in the head of water above normal value, but the loss of generator excitation or a considerable drop in system voltage will overload the generator. If overload

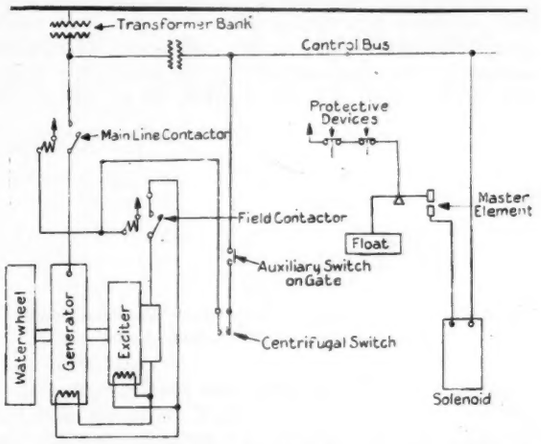


Fig. 4.—Control System Adapted to Various Automatic Generator Installations.

occurs, however, from any cause, overload or thermal relays will disconnect the generator from the line and close down the station. A centrifugal switch or an emergency tripping device on the governor, if one is used, closes down the station in case of overspeed of the generator. Other refinements in the application of protective devices may be added, such as differential relays for protection from internal generator trouble; low-voltage relays to prevent single-phase starting or operation, and relays for overvoltage protection of the generator and exciter.

Relative Merits of Synchronous and Induction Generators.

Synchronous generators require direct current for excitation; therefore, auxiliary equipment for furnishing the exciting current, and control equipment for the auxiliary apparatus, must be provided for each automatic synchronous-generator installation. On the other hand, induction generators are dependent upon the systems to which they are connected for their excitation; hence, auxiliary apparatus to furnish or control their excitation need not be furnished. Since the exciting current taken by an induction generator lags 90 deg. behind the power component of current the addition of an induction generator to a system already overburdened with a large lagging current makes conditions worse. Thus, while a 500-kw. induction generator having a 90% power factor will deliver 500 kw. in energy, it requires a wattless component of 242 kv-a. from the system for its excitation. This condition is illustrated in Fig. 5.

Where systems must supply a heavy lagging current with no spare synchronous-generator capacity available the addition of an induction generator is generally not advisable, but where systems have extensive high-voltage transmission lines and the power-factor is high the installation of an induction generator may make a more economical development. In a high-head instal-

lation requiring a high-speed generator the induction type will usually cost less than a corresponding synchronous generator with its exciter. In a low-head installation requiring a slow-speed generator the induction type may equal or even exceed the cost of a synchronous generator with its exciter.

The use of induction generators with the control schemes previously described will, in each case, eliminate the exciter and the apparatus necessary for the control of the generator field. For illustration, the substitution of an induction

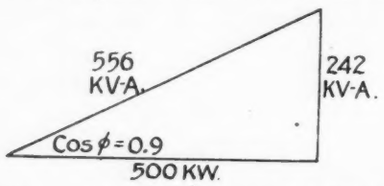


Fig. 5.—Diagram Showing Power and Wattless Components of Induction-Generator Load.

generator for the synchronous machine in Fig. 1 eliminates the exciter, the field contactor and the synchronism indicator, but it makes necessary the addition of a centrifugal switch which will close its contacts at synchronous speed and light a lamp or give other indication at the hand-controlled plant through a third pilot wire. As a second illustration, an induction generator substituted for the synchronous machine, in Fig. 4, will eliminate the exciter and the field contactor. For each proposed automatic installation the characteristics and the cost of two types of generators should be considered and the type of machine best suited for the development should be selected.

DETERMINATION OF STANDARD FOR WHITE LIGHT.

Color of Light From an Artificial Source Depends Upon Its Temperature—Sunlight Nearly True White Under Certain Conditions.

The definition of "white light" naturally constitutes an important part of the scientific foundation of colorimetry. If we consider incandescent light sources generally (including oil and gas flames, carbon and metallic-filament electric lamps) we find that the light from sources at comparatively low temperatures evokes reddish or yellowish colors. As the temperature of the source increases, the color becomes paler and paler yellow and, at higher temperatures, approximates to "white." However, all artificial incandescent sources are decidedly yellow in comparison with sunlight, since it is not possible to operate an artificial light source at a sufficiently high temperature to color-match sunlight. We are led to anticipate, however, that a source at a sufficiently high temperature would color-match sunlight, and, further, that sources of still higher temperatures would appear blue relative to the sun. The question arises as a matter of physiological optics as to what temperature would be required to cause a light source to appear under standard conditions of observation neither blue nor yellow, but white. A further question then arises relative to this standard—is the sun blue, yellow or white? Recent experiments made at the Bureau of Standards answer these questions insofar as four observers are concerned. They are the first accurate experiments of this nature ever performed. The answers are:

Theoretical.—The temperature which a hypothetical source would have in order that its light might evoke the sensation white (the hueless sensation of brilliance recognized as neither bluish nor yellowish) would be about 5200 deg. C. absolute.

Practical.—The light of the average noon sun at Washington evokes a sensation very closely approximating white.

These experiments and their results were described at a joint meeting of the American Physical Society and the Optics Society of America in Chicago, Dec. 29, 1920. It is expected that they will be described in detail in a forthcoming publication of the Bureau of Standards, and persons desiring further information should address such request to that Bureau, attention of Division 4.

LIGHTING FIXTURE DEALERS' SOCIETY OF AMERICA.

"We Light America," Is Slogan of Retailers' Organization Whose Aims and Qualifications for Membership Are Here Set Forth.

The objects of this Association are: The advancement of the retail lighting fixture business, the reform of abuses therein, the promotion of

W. A. Hadler, President.

friendly relations between the different elements in the trade, the establishment of closer relations with all manufacturers in these lines and the improvement of conditions of general interest by all proper and legitimate means. The slogan of the Lighting Fixture Dealers' Society of America is, "We Light America."

Any individual or firm is eligible to membership who maintains a retail show room and displays therein lighting fixtures, glassware, trimmings and kindred articles, and who has a complete organization devoted to the buying, selling and installing of lighting fixtures, and whose application for membership has been acted upon and approved by the executive committee.

Special Problems in Illumination of Steamships

Co-operation Between Shipbuilder, Manufacturer and Contractor Should Improve Existing Conditions and Result in Large Volume of Business in the Expanding Lake and Ocean Shipping Fields

By R. W. PEDEN
Edison Lamp Works, General Electric Co.

Ship lighting is an interesting and broad subject, for the modern passenger vessel is virtually a small town with diversified lighting demands just as found on shore. The problem is further complicated by the fact that there is a minimum of space available for hanging fixtures. There are no walls in which to conceal the wiring and, in the majority of cases, it is impossible to take advantage of many of the methods of installation which are used on land and which add much to the appearance of the system in general.

It is interesting to note that the steamship *Columbia,* built in 1879, was sent to New York City in 1880 to be fitted with the first Edison incandescent lighting plant that was ever installed for commercial use. The original methods of application were indeed crude compared with present-day standards.

Ship lighting has since advanced by rapid strides, but the decorative features have progressed faster than the utility developments. This is parallel with other experience. Industrial lighting, for example, has been long neglected, glaring and inefficient sources being employed. The day is not far distant, however, when those having authority over ships will realize the advantages of modern lighting equipment. The lighting of the working parts of the ship offer the greatest opportunity for improvements.

Special Requirements in Wiring for Light and Power Service.

Escape from a ship at sea is always accompanied by considerable danger and, therefore, it is most essential that the fire hazard be reduced to a minimum by employing only high-grade wiring systems and suitable fittings.

In passenger vessels, especially, precautions should be taken to include duplicate generating equipment. Both turbine generators and vertical reciprocating engines are used as prime movers. The capacity of generators ranges from 1 kw. on small vessels to 400 kw. on large ocean liners.

The advantages of strength and reliability of 110-volt lamps have been generally recognized and 3-wire 220-volt, or 2-wire 110-volt, distributing systems are employed. In the best installations the power and lighting circuits are separate. The protection of feeders is one of the most important considerations in the wiring of a vessel. Preservation of the life of the traveling public and continuity of service both depend upon it.

Special Requirements of Fixtures for Ship Lighting.

The electric fittings used on board ship must be of strong, substantial design and sufficiently rigid to withstand the motion of the vessel. In general, the low head room makes it necessary that they be short. The three general classes of fixtures to be found on the modern vessel are: (1) Special ornamental or decorative fittings for the salon, music hall, smoking room, first-class dining room and the like (these are of the same general type as used on land); (2) utility-type fixtures, such as are employed in the general state rooms, passageways and similar parts of the boat (these correspond to the commercial type of fixtures used where especial attention is not paid to artis-

View Showing Ornamental Fixture in Social Hall of Coastwise Vessel.

tic results), and (3) water-tight fittings such as are necessary in the engine-room, on the open deck and other parts of the vessel exposed to the elements.

The essential parts of a water-tight fixture are a cast-iron or steel fitting into which a glass inclosing globe may be screwed, and a rubber gasket placed between the metal and glass. The metal fitting is attached to the conduit or may be fastened to a water-tight pull box. Most water-tight fittings are so constructed as to make possible the attachment of a wire guard for protection of the globe from mechanical injury. Clear mazda lamps are usually employed, although in many instances frosted or enameled lamps are desirable on account of the added diffusion. Reflectors are rarely used, although they can be satisfactorily accommodated to this type of fitting, and their use would prove of value in many cases.

Common Practice Demands Artistic Installation in Salons.

The decorative element of lighting is predominant in salons. If space permits massive ornamental ornate fixtures are employed; often of special design as indicated in an accompanying illustration. No set rules can be laid down for the lighting as the keynote of an artistic installation is originality, but whatever system is employed it should serve to make the room comfortable. Bright light sources, particularly against dark backgrounds, are glaring and annoying. An average intensity in the neighborhood of 2 or 3 foot-candles is adequate for the purposes for which these portions of the ship are used. Where the ceilings are low it is necessary to employ a number of smaller units to get a suitable distribution of light.

The warm, cozy effect necessary when illuminating a writing room or library is obtained by the use of a low intensity of general illumination from some form of decorative overhead fixture supplemented by candlestick brackets or sconces. Suitably shaded decorative reading lamps on the writing desks give another touch to the installation. A library on a large liner where this general scheme of illumination is followed is pictured in an accompanying illustration.

The dining room of the modern ocean liner offers conditions quite similar to those of the first-class hotel grill room with its low ceiling. Two practices exist as to lighting—the provision of a sufficient intensity of general illumination by means of small rather closely spaced overhead units, or the use of a low intensity of general illumination supplemented by local or table lamps throughout the room. The second practice is pictured in the accompanying dining-room scene. As would be expected, the lighting in the second- and third-class dining rooms is considerably less ornate and the fixtures are of a more utilitarian character.

The decorative requirements and the necessity for comfortable lighting are common in the smoking room as well, and individuality of treatment is desirable. A moderate intensity of general illumination, approximately 3 foot-candles, is desirable in order that card games may be indulged in without eye strain.

State Room Needs Much in Way of Lighting.

The state room is essentially the bedroom of two or more persons. It must at the same time be the lady's boudoir, the gentleman's dressing room, and not uncommonly it is called upon to take the place of the hospital ward. Thus, there are four distinct rooms in one which seldom occupies a space greater than 8 by 8 by 7 ft. Despite the minimum space available the traveling public wants the same conveniences on shipboard as are found on land under similar conditions; that is, the bedroom must have good general illumination supplemented by reading lamps at the heads of the beds. The boudoir must be so lighted as to produce a warm and cozy effect, at the same time supplying ample illumination on the dressing table. The men's dressing room requires good illumination at the mirror for shaving while the hospital ward calls for a subdued light which will add to the comfort of the patients and yet permit the nurse or attendant to move about with facility.

It is obviously impossible to meet all these requirements in the most effective manner in the space available, and as a result, in many instances, very little consideration has been given to the lighting of the state room. In the typical average installation a single unit consisting of a very simple type of ceiling receptacle with a round-bulb all-frosted mazda lamp is placed in the center of the open space. At the side of the berth there is often a portable auxiliary unit.

In some of the more recent installations the

Ocean-Liner Dining Room Not Unlike Modern Hotel Grill.

Ceiling Fixture and Silk-Shaded Wall Sconces Employed in Ship Library.

first-class state rooms of modern ocean liners have very elaborate systems of lighting. Such installations are very satisfactory and illustrate what an important adjunct proper lighting is for comfort and convenience.

Special Needs of Work Areas and Engine Room.

The U. S. Navy has conducted scientific research along the lines of the physiological effect of proper and adequate lighting on the crew and on the consequent handling of the ship in general.

It has been shown that good illumination creates cheerful surroundings, inspires endeavor and results in better performance. In addition to preventing accidents that are caused by inability to see clearly, it enables the crew to move about their work quickly, easily and with confidence. These factors make possible the proper and rapid loading of the vessel, thus economizing time at the dock and preventing the shifting of cargo when at sea.

It is very difficult to illuminate properly such spaces as the engine and fireroom on account of the multitude of overhead pipes, beams and deck supports. The surroundings, too, are often of a dark color. It is often necessary to make repairs when at sea or under other circumstances where time is a valuable asset, and since a very high intensity of light is thus temporarily rendered essential, numerous outlets for auxiliary units must be provided.

In modern installations the type of fixtures are materially the same as those employed on land under similar conditions, but the addition of suitable reflectors and diffusing mediums adds materially to the utility and appearance of the entire system. A comparison of various installations reveals the advantage of a white finish for interiors.

Light in the galley is essential for three purposes: First, to enable the cooks and other attendants to prepare the meals with sanitation and ease; second, to supply a light of sufficient intensity to impart confidence to the stewards as they move around with loaded trays, and, third, to insure the rapid loading and handling of supplies.

Since the benches, tables and cooking ranges serve as the boundaries of the various passages, good results may be obtained by installing a sufficient number of units over the former. Since the ceiling is usually a pure white, reflectors are not as essential here as in many other areas. Glaring clear lamps and clear globes should always be avoided, and the units should be placed close to the ceiling rather than hung low, because glare and accidental breakage is thus diminished.

Freight Decks Need More and Better Equipment.

From the point of view of the illuminating engineer the freight decks are practically an untapped field. The majority of modern ships have no permanent artificial light in the freight spaces because there is no fixture on the market today which is rugged enough to withstand the service to which it is here subjected during loading and unloading; also, construction of these spaces and the use made of them renders it difficult to so conceal the wiring as to adequately guard it against injury.

Portable units are now in use in these spaces. These are of the multilamp type and employ porcelain enamel reflectors. Some installations provide vapor-proof portable receptacles on each deck at the hatchway, but this is an unsatisfactory arrangement as the portable units are in the way and the conduits are often wrenched from their fastenings.

Speaking of the working areas in general, the absence of good illumination cannot be attributed to economic causes. Most landsmen are forced to buy power from an independent company, but ship operators generate current for their own use and consequently pay a minimum price. Hence, from a supply point of view, the ship owner has the advantage of his brother on land, yet has been slow to profit by the result of recent experiments.

The remedying of this condition is a problem which can be solved only by extensive experiment and close co-operation between fixture manufacturing companies, contractors, shipping concerns and insurance authorities. There can be no doubt that infinitely better systems than those in use could be found.

Deck Lighting Arranged to Allow Passengers to Enjoy Night Scenes.

On the modern ocean liner passageways are so constructed as to allow two persons to pass each other, yet each passage may serve as the gateway

for 100 or more state rooms. These passages are generally located between two rows of state rooms, hence very little daylight can penetrate to them and artificial light must be used continuously. A good general illumination meets the requirements at all times, but it is advisable to have some device for increasing the night intensity over that used in the daytime. Here, as in other parts of the boat, flat-white finish of surroundings reduces glare and gives better diffusion.

The illumination on the open decks should be sufficient to reveal obstacles, but a high intensity is not desirable for the public prefers to take full advantage of moonlight scenes on the water and this is impossible when the local illumination is intense. The lighting arrangements vary but little, vapor-proof fixtures being placed overhead at distances from 15 to 20 ft. Clear outer globes are most common with clear mazda lamps as the source of light.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS.

Ideals and Objects of This Nation-Wide Organization Embodied in a Code of Great Benefit to Public as Well as Its Members.

The National Council of Lighting Manufacturers was organized in February, 1919. Twenty far-sighted manufacturers, convinced that the future of the fixture industry lay in co-operation, rather than ruthless competition, met together at Pittsburgh and formed the nucleus of this organization—now nation-wide in its membership.

At the meeting at Cleveland in August, 1919, the by-laws were adopted. The membership had now increased over 50%, 35 firms being members.

At the second annual convention in Buffalo the membership rose to more than 120 firms—an increase of 1200% as compared with the original membership of 2 yrs. ago. Such a phenomenal growth proves the value of the work which the National Council is doing.

The following creed was a feature of the joint program of the "Associated Lighting Fixture Industries" at the Buffalo Market:

OUR CREED.

1. To win on our merits.
2. To be the best and largest organization of its kind.
3. To be broad and liberal as well as aggressive in our policy and methods.
4. To take a pride in our institutions and achievements.
5. To be loyal to the organization and to each other.
6. To foster good-fellowship among ourselves, and to take pleasure as well as profit out of our work.
7. To strive constantly for the improvement and advancement of the industry and ourselves.
8. To be considerate, polite and courteous in all our dealings within and without the organization.
9. To aim high, and dare to do big things.
10. To grow in knowledge and character as well as in size.

The "Ideals and Objects" of the National Council of Lighting Manufacturers are set forth as follows:

1. The betterment of trade conditions in general, and the exposition and suppression of unfair methods of competition.
2. The elimination of the practice of appropriating designs or reproducing patterns of any competitor.
3. The encouragement of local organizations of Lighting Fixture Manufacturers in the various manufacturing centers and their unrestricted access to all districts.
4. To be of assistance to and to co-operate with, wherever practicable, the local and national dealers' organization.
5. To create a demand for a higher artistic standard of lighting fixtures by all those engaged in the industry and the public.
6. The adoption, where practicable, of uniform trade customs with reference to packing and boxing charges, terms, cash discounts and exchange of credit experiences, etc.
7. To secure for ourselves satisfactory treatment and terms from our own respective sources of supply.
8. For the exchange of ideas on cost accounting, shop and office practice, etc.
9. To take active interest in affairs pertaining to or in any way affecting our industry.

HANDY PORTABLE REFLECTOMETER FOR GENERAL USE.

Integrating Sphere Used With Small Section Cut Away—Constancy of Sphere Surface and Light Source Not Essential to Accuracy.

In Bulletin No. 35, item 3, and Bulletin No. 42, item 16, issued by the Bureau of Standards, an improved and simple portable reflectometer was briefly described. A complete description of the instrument has been published in Scientific Paper No. 405, which may be obtained from the superintendent of documents for $0.05 a copy. The instrument is a sphere with a small segment cut away leaving a hole over which the surface to be tested is placed. The wall of the sphere is viewed through a small hole by means of a portable photometer, the spot viewed being screened from the test surface. A lighting tube set at an angle to the sphere surface is arranged to rotate about an axis normal to the surface of the sphere so that the direct light can be thrown on the test surface or on the sphere wall.

The theory of the integrating sphere shows that the reflection factor of the test surface is simply the ratio of the photometer readings in the two cases, no assumption being made as to the way in which the light is reflected from the test surface. Moreover, the reflection factor measured is not affected by selective reflection from the sphere walls. No accurate voltage adjustment of the lamps in the photometer and the reflectometer is necessary as both operate from the same battery. The use of a low-voltage flashlight lamp in the lighting tube makes the instrument very portable and convenient. An absolute instrument of this type is much better than an instrument giving relative values, because no standard surface is required and it is not necessary for the lamp or sphere surface to remain constant from day to day. By addition of an exterior light source the same instrument can be used to measure transmission factors of clear or diffusing media.

Looking Forward in the Electric Lighting Industry

Leaders in the Illuminating Field Give Expression to Enlightening Views That Inspire to Greater Electrical Achievements Through Collective Effort and Standarized Business Methods

Those who attended the convention and fixture market of the Associated Lighting Fixture Industries held recently in Buffalo may well look forward to greater achievements in the electric lighting field. It would require a small library to recount all the beneficial messages and resulting plans heard and discussed on that occasion. Throughout the entire week "Co-operation" was sounded as the keynote and inspiration that will carry the lighting industry with greater determination to greater success throughout the year.

Not all of the instructive messages delivered at the Buffalo convention are available for publication here. Those given below have been taken at random, without effort at selection, but they represent well the sentiment of the industry. Many a gem of thought from those papers from which the following extracts are taken, and from those not here mentioned, will live long in the minds of the fortunate men who heard them. The first paper, extracts from which are here presented, was entitled "Stimulation of Design," by W. R. McCoy, manager, Commercial Department, Cassidy Co., Inc., Long Island City, N. Y.

W. R. McCoy Discusses Stimulation of Lighting Fixture Design.

"Design" means an idea represented graphically, or in other words, the picture of a fixture not yet constructed; therefore, it does not mean a finished fixture. We want to stimulate the ability to produce ideas because the ultimate outcome sought for is fixtures that are the result of good design.

There are two problems that have to be solved to secure the desired result: first, the protection of designs and fixtures resulting therefrom, and secondly, the increase of the production of design of new ideas that shall ultimately become fixtures. We are interested principally in finding a solution for the second problem or to stimulate designing ability.

Like every good physician, before we attempt a cure we must first diagnose the disease. The first symptom is the running sore of design and fixture pirating. This phase of the question has discouraged more designers than any other one thing. An example of this happened some years ago when a company now out of existence employed a large designing force under the supervision of a designer who was and still is a genius. This designing department was an expensive one to maintain and the results in the advancement of good design were not worth its cost to this concern. From their designing department came a series of fixtures that are found today in every single fixture dealer's shop in this country. This company went into the hands of a receiver; nevertheless, hundreds of thousands of dollars accrued to those copying the designs.

To create means great expense, which must come back in the selling price of the goods. To pirate means practically no expense and a lower selling price. The result of all this is that one of the greatest efforts to advance designing has been throttled and the support and encouragement necessary to develop the designer has failed.

Another symptom is the general lassitude of the industry towards development of design. We have hook-worm in malignant form. How many of us employ designers? Very few; therefore, what is there for a designer to strive for? There are probably a half dozen positions in the entire industry in this country that are worth the struggle and there isn't a single man within the sound of my voice who has put half the effort in attaining his position of affluence that any one of the men that hold these half-dozen envied positions have done. Theoretically this can be overcome.

For the sake of illustration let us consider an impossible condition. Suppose every individual or group of men who started to manufacture lighting fixtures was compelled to employ a designer. This would immediately bring about a competition among those who already are designers for these positions, which in turn would open up positions for the more competent of the draughtsmen and a new corps of draughtsmen would have to be created, thereby stimulating those now studying design to seek employment in this industry and there would be no problem.

But how can we expect designing to go forward if we do not furnish employment enough to take care of those who have arrived as well as those who are being trained? Recall the men who occupied foremost positions in designing 10 years ago and you will find many of them entirely out of the field or giving it only part of their time. Recall the promising material that sat behind the drafting boards; the young men whose ability should have made them our foremost designers today and you will find that many of them are in other lines of endeavor. Therefore, does not the diagnosis show that the ailment is due to lack of protection and the lack of opportunity?

What is the remedy? As already suggested, your committee on fixture design has devised a plan that will help you protect the work of your designers. What can we do to overcome this lack of opportunity? We certainly cannot ask every manufacturer to make room in his organization for a designing department. The small manufacturer would find that in a short period of time a designer would produce more designs

than he could afford to manufacture in years. The reason why the firms that maintain such departments find them of value is that they are retailing to a clientele demanding new things and willing to pay for them. The average firm that does a wholesale business could not stand the cost.

There have been two remedies suggested that to my mind do not meet the situation. The first is a convention of designers; second, competition of design. Among the present designers the first plan, I fear, would fail because altruism does not buy soup. The designer is most jealous of his ability, and justly so. If we as manufacturers can discover a process of doing something a little better than our co-member we are inclined to guard that process jealously because it may be the difference between our success and our failure. We are willing to give the results to the trade, but not the method. No great surgeon was ever created by attending conventions. He became great through the opportunity to practice his profession. Therefore, I do not see any remedy in a convention of designers.

Another suggestion was a competition of design among our members for a money prize or a blue ribbon, the winning design to become common property. Would this stimulate design? I do not think so. Design is a matter of slow development and designs cannot be stamped out like so many canopies. Our designers at present are too busily trying to meet the demands of their employers for original things to be able to give the time and thought to really produce anything worth while for a prize competition.

I believe that we must turn to an entirely new and original plan for stimulating design; that this plan must go beyond the confines of the present business; that it must grant equal opportunity to every member of this association to participate in its advantages. It must bring in new blood in the designing field and show that there is material gain in fixture designing. It must do this without bringing an undue burden on the small manufacturer. Therefore, gentlemen, it is proposed as a solution that there be established a "National Academy of Fixture Design."

I will outline the plan in mind very briefly. First, that this academy be composed of members of this association under the direct control of our National Board, thereby confining its benefits to the members; that it be composed of men who are not designers; that they be appointed for a term of years that will prevent an interruption of consecutive endeavor. With such a group of men we have a start towards constructive development.

The academy would then seek designs only from those outside of the trade. Invitations would be extended to all academies of fine arts, trade schools and other similar sources to have their pupils submit suggestions. A series of rules should be compiled by the academy governing the details of such a plan which will prevent the designer from going astray regarding the mechanical construction of such fixtures. Such suggestions as are submitted should be passed on only as to their practicability and not as to their artistic merit. At each convention these designs, carefully numbered and cataloged, would be placed on private exhibition for the members of this association.

The academy should have no discretion as to what may be exhibited—everything submitted must be shown. However, those that have artistic merit might be copyrighted. On the last day of the fixture mart these designs would be put up at auction and be disposed of to the highest bidder. The design, including the copyright, would become the exclusive property of the purchaser. The academy should establish a minimum bid that will be accepted; this minimum price to be uniform in all cases. The purchase price in every instance should go to the creator minus the copyrighting cost, plus a small fixed fee to cover expenses. In the main, this outlines the plan. Minor details could be worked out later.

Fred Farmer and Charles Hofrichter Tell How Co-ordination Pays.

We have a unique opportunity to demonstrate to the other branches of the electrical industry that we really believe in co-ordination. Most of us do believe in the advantages of co-ordinated effort. But some of us have the idea that it is really rather nice of us to think so well of co-operation and to help it along—that co-operation, however good it may be for the trade in general, is more of a liability on the books of our own personal business than an asset.

But co-ordination pays. It is an asset. It isn't possible to help the fixture industry as a whole without also helping yourself. As co-ordinated effort brings to light more and more business opportunities, you will inevitably benefit also in just as much proportion as your own sales organization is able to take advantage of the wave of better business. As the Conciliation Board of the National Council gradually suppresses unfair practices there will be less and less of the piracy of designs, etc., which in the past has thrown such a burden of extra cost upon the manufacturers—which extra cost has necessarily been passed on to the ultimate consumer. And you benefit again.

With the standardization of lighting fixture parts—another proposition which can only be put across by co-ordinated effort—another contributory cause of waste and high selling cost in the fixture industry will be eliminated. The manufacturer will be able to reduce his production costs and the jobber will be in a position to supply high-class fixtures at a cost which will bring them within the means of thousands of prospective buyers who are now beyond our reach. So that whether you are manufacturer, jobber or dealer, you gain.

The other electrical industries—the motor manufacturers, the switch-gear makers and others—are watching us closely. They are waiting to see whether this great $200,000,000 product of the electrical business is a solid organized force for better business, with which they can co-operate and feel proud of—or whether it is a huge disorganized collection of dealers and manufacturers, each interested only in himself.

Which do you think? Sure. Then prove it by your actions at Buffalo and in the future. Upon this convention and Fixture Market depend much of the prosperity of the fixture trade

for 1921. Attend every meeting you possibly can. Give your association the benefit of your experience. Get acquainted with the crowds of other dealers and manufacturers to whom you are now known only by letter. Help to boost our industry to its proper "place in the sun."

None of us need be afraid of coming conditions. It is not the wideawake manufacturer who has standardized and systematized his products to obtain lower manufacturing costs, who is alarmed at the prospect. He knows that the new conditions, by eliminating obviously unfit competitors, will make success less difficult to attain.

The skillful workman, no longer compelled to work on an equal pay footing with his less skillful shopmates, will find that his knowledge will be rewarded, as it should be, by higher proportionate pay. Incidentally, too, the dollars we earn will be real-honest-to-goodness dollars whose purchasing power will be 100 cts., instead of 50 to 60 cts. as in the past year or two. "Are we downhearted? No!"

There are thousands of prospective customers for our fixtures who have never before had either the money or the desire for artistic lighting fixtures. This field of business has so far been scarcely touched, and its extent will probably astonish us when we get fairly after it. Apart from this hitherto untapped reservoir of prospective business, the building trade itself is due for an enormous expansion. This inevitably means more lighting fixtures. It may mean—if we are alive to the educative possibilities—better fixtures, as well as more of them. Now that "normalcy" has been attained, there is no further reason why the thousands of buildings for which permits have been already issued (but which were postponed until conditions became more settled) should be delayed.

But there is no need even to count on what the building trade will do. We already have a huge unsaturated market at our very doors. But of the 20,481,700 dwellings already built in the United States, over 14,000,000 are not yet wired for electricity. Of this vast number it is estimated that nearly 5,000,000 of these homes are within the present supply area of the central stations—a field ready prepared for the wide-awake fixture dealer. There are about 1,000,000 industrial and commercial institutions—and how many of them are adequately lighted? Here, too, is a fruitful field for the "go-getters" of the fixture trade.

Another coming business possibility is to be found in the replacement of gas fixtures in homes and commercial institutions. Slowly but surely the available supply of natural gas—the only method of illumination which could give cheaper (if much less reliable) lighting than electricity—is nearing its end. Once a well is exhausted that is the end of it. And the natural gas companies are now scarcely able to properly serve the customers they already have. They are in no condition to go out after this field of business. But the electric lighting fixture men are. Long before we succeed in securing the business which lies, so to speak, at our very doors, still further possibilities will be opened up through the extension of central station service lines into areas which have so far remained untouched.

Figuring out the enormous possibilities of new and profitable business which is looming up for the lighting fixture industry, who could fail to feel enthusiastic as to the future? There is little doubt that our industry will quadruple itself within the next 10 yrs., if—

If what? If we help things along by co-ordination, by educative campaigns, by getting together with the central station engineers in our respective sections, by showing through advertising and publicity the advantages of more and better lighting, by going out after the business thus stirred up.

Herman Plaut Tells What New York City Is Doing.

The year 1920 has been one of progress, expansion and harmony in our city. Never in the history of the fixture industry has there been such a strong feeling on the part of the members about the merits of a strong trade organization, and in New York City both the Uptown and the Downtown Councils are a unit in our sincerity in this belief. In the Uptown Council we have spent a very busy and a very useful year. Our New York section was organized only Sept. 24, 1919, and is, therefore, less than a year and a half old, but we have accomplished some very excellent results.

Herman Plaut,
L. Plaut & Co., New York City.

One of the principal results accomplished by me has been the matter of the individual agreement between employer and employe. Under this arrangement the men sign up with their employers for a period of 1 yr., and this agreement cannot be broken except on 30 days' notice in writing. The result is that we are not subject to a sudden walkout of our men, wages are standardized for the period of the contract, and a much better understanding exists. The result has been that in the year 1920 there have been no strikes in New York, and the labor situation today is in a far better condition than at any other time.

Another important piece of work accomplished

by us has been in behalf of dispensing with the use of the insultant joint. The New York Association has spent at least 10 yrs.' time and a great deal of money in bringing about this situation. Committees have made trips to Chicago and have been very energetic in pressing the matter. Thanks are also due to the trip which Fred R. Farmer made from Chicago to New York in behalf of this movement.

Another gratifying accomplishment has been the joining of the Brooklyn manufacturers with the Uptown Council. We welcome this addition to our ranks and feel that now and hereafter we will have peace and harmony in Greater New York. We have appointed a committee to take up with the glass manufacturers the matter of more reasonable charges, particularly in the matter of service charges and packing.

We have retained counsel in the matter of the uniform contract to be adopted and used by all the members of our association, and commend its usefulness to the entire industry and place at their disposal a copy of the same. We have appointed many useful committees, such as on immigration, design, trade co-operation, etc.

One of the best results we have in mind is the work to be accomplished by Henry d'Olier, of Bridgeport, Conn., in the matter of standardization. Mr. d'Olier is a tried and skilled expert of the highest efficiency and is working out a set of gages, taps and dies for lamps, wires, sockets, in fact, for all the material that we use, and if his work can be uniformly adopted it will be of the greatest value to the entire country. The work he is doing is for the benefit of all and is a larger subject than the New York Council individually can handle. We are, therefore, going to ask the National Council to view Mr. d'Olier's work, and have little doubt that they will be greatly impressed by it.

Another matter we have taken up is a committee on "Architects and Engineers," for the purpose of having the appropriations for lighting fixtures determined when the building is planned, and not when the building is finished. The heavy increase in the cost of the building generally results in cutting down the cost of lighting fixtures; but if a definite amount were appropriated when the foundations were laid, this condition would be largely eliminated.

William Horn Tells What Philadelphia Is Doing.

The Philadelphia Club has done more in its short life to bring about a much needed friendly intercourse, a business friendship and a generally cordial good feeling than was ever thought possible or dreamed of. We members in Philadelphia not only call each other by our first names and go on fishing trips together, but we actually, on one of our outings, slept in the same beds.

This most desirable good fellowship tends to place the industry on a higher level, on a level where it rightly belongs; on the same plane as kindred industries have enjoyed for many years, and solely, I believe, due to organization—an organization which promotes a friendly rivalry instead of a cut-throat competition and affords us the opportunity of discussing in a brotherly way our trials and tribulations.

You have, no doubt, heard that old jibe at the fixture business, in referring to a group of three men: "There were present two gentlemen and a gas fixture salesman." That about expresses the low level into which the fixture business had sunk, and you only have to look back at the history of the business to learn that it is a trail of failures, sheriff sales and bankruptcies, largely due to the absence of organization.

We, in Philadelphia, who have cultivated a fellowship entirely and absolutely the result of organization, have arrived at the point where we can grasp and see the other fellow's point of

William Horn,
Member, Horn & Brannen Manufacturing Co., Philadelphia.

view. We have found that the other fellow is just as capable, honorable and trustworthy as ourselves. One learns through organization that most of your competitors are just as practical as yourself, in that they know the necessity of showing a profit on each and every transaction, but that prior to the formation of the organization, they feared the cut-throat, price-cutting, jealous, suspicious attitude of their rivals.

The discussions indulged in at our Philadelphia meetings have been exceedingly interesting and profitable. The exchange of views and opinions has indeed been of much benefit, and I would enjoin all of you gentlemen to encourage a lively interest in your local meetings, as I believe it will be of special benefit to each of you during the period of reconstruction through which we are now passing. That about answers, "What Is Philadelphia Doing?" but I would like your attention while I express, briefly, some views on the industry in general.

What has the National Council of Lighting Fixture Manufacturers done for us? During its very short life it has resulted in a regeneration of the industry, and it is the inspiration of all we have accomplished in Philadelphia. From what I have seen and heard in the past year in the various cities I have visited, it has placed the industry on a much higher level and stronger footing.

The aims and objects of the National Council have caused us to change our methods and policy in several respects, one of which was the wasteful willingness to make special sketches. Our company never did encourage entering a dealer's territory and figured direct to the consumer. We not only always endeavored to cooperate with the local man, but with the advent of this organization we have made every effort to discourage the making of sketches for special fixtures. We have, on the other hand, lent our efforts to producing a wide variety of high-class designs, thus enabling the local dealer to handle the situation without recourse to sketches, which, in turn tends to sharpen the wits of the dealer's salesmen, who heretofore had no hesitancy in calling on one of the fixture factories for special designs.

Bernhard Blitzer Reports for Lower New York Division.

The Downtown local of Lighting Fixture Manufacturers' Association is in a very healthy, thriving condition. The growth has been rapid, and the association now has 38 active members. Attendance at the monthly meetings has been very satisfactory, the average being over 90% present during the entire year.

One of the constructive measures brought to pass this year has been the creation of an arbitration board. This board is designed to arbitrate any differences between members, on any subject, but principally on a plan for infringement of design patents, or pirating of designs. It is the hope of the Downtown New York Conference that the national body will create a similar board of arbitration, which can be used by the New York members as a board of appeals in the event any decision rendered by the Downtown arbitration board is not satisfactory.

While no definite action has been taken, there has been growing a sentiment against the old practice of competing for labor, and of one manufacturer taking a laborer away when he is already employed by another one. Uniform working week of 48 hours has been established and is being maintained.

On the whole it has been the aim of the association to foster a spirit of fair play among the manufacturers toward labor. While the association is growing in influence it is contrary to the policy of the association to use this influence in any way not consistent with our policy of giving labor a square deal. The open shop conditions have been and will be maintained.

W. E. Cochran, president of the Cleveland Division, showed how, through unity and cooperation, a serious labor problem was satisfactorily adjusted for Cleveland members and told of plans for an apprentice system and a pay schedule for workers based upon efficiency, with inducements for each one to improve his skill. Mr. Cochran presented the following paper:

Institution of a Prize Contest in the Fixture Industry.

We have now reached another mile-stone on our journey, and there is certainly cause for deep rejoicing at the wonderful progress that has been made and it is indeed doubtful whether any other combination of interests has ever had the wholehearted support, from all its members, as has this movement in the lighting fixture industry.

We have come thus far with a full head of steam, and the throttle wide open, and so great has been the speed that it has been impossible to get more than a fleeting glimpse of the landscape passed.

But in order to maintain this same momentum in the future, we must pause long enough to analyze some of our problems, and it is logical that the question of standardization and protection of designs, should be the first to demand attention, for on the right solution of this question rests, to a very large degree, the future success of all our plans.

The lighting field is divided into three parts—residential, commercial and industrial—the residential occupying the place of first importance. Up to the present time the residential lighting field has been unhampered by restrictions of any kind; there has been room for the sale of the cheaper, as well as the most expensive and artistic lines.

This very fact has been both an advantage and a disadvantage to this branch of the lighting field. The disadvantage, because it has provided a fertile field for the practice of dishonest business methods, and for the sale of merchandise that was defective, both in workmanship and material, causing loss of confidence of the buying public whose friendship we must maintain if we are to succeed as an industry. The advantage, because it has provided unlimited freedom for the individual to work out, develop and market his ideas, which has stimulated the search for better and more efficient fixtures, and has at the same time prevented the industry from becoming standardized to such an extent that it could be controlled by any large interest.

To any one who has given this matter any serious study it must be evident that there are certain tendencies at work today aiming at the control of the commercial and residential lighting field, similar to that which now exists in some other lines of the electrical industry, and there is no doubt but that there are certain changes going on in the lighting industry that are bound to have a direct influence on the present designs of residential lighting fixtures, and it behooves all of us who are engaged in the manufacture of this line to study this trend carefully and either prepare ourselves to defend our present position or to accept the changes that are taking place.

In order, therefore, that we shall be able to better defend our position, we are in need of a working foundation that will provide among other things the following: First, protection against the encroachments of other interests on our legitimate field; second, encouragement of our artists, designers and inventors; third, protection against the pirating of designs and the expense of court litigations, and fourth, a better working plan for our employes.

I will take up each of these subjects and make a few suggestions in the hope that they will encourage a wider discussion on the part of all present, in the time allowed as for free discussion.

Taking first the subject of encroachment. This involves the need of gathering and tabulating all of the available data obtainable relating to our

industry so that we may register our protests in an intelligent and constructive manner; it also involves the carrying out of a national campaign of publicity, to encourage the buying of a better grade of home lighting. This in turn involves the question of raising funds for this work, and this should be obtained from our present labels and stamps, and possibly by increased dues, and a series of prizes could be offered for the best suggestions from the members as to the manner in which the National Council label could be used for this purpose.

Taking up the second subject, the encouragement of our designs, and I wish to call attention to the fact that when I refer to a design I have in mind a finished product and not a drawing. This involves the need of a closer co-operation with every other branch of the industry, so that in making up new designs or working out new ideas, each branch of the industry may be fully informed, and in this way be better able to design an article that will fit into the ideas of each other. To encourage the designer, artist and inventor, and to better stimulate their efforts, we should establish prizes which may take the form of a silver trophy to be contested for yearly at our regular meetings; cash prizes could also be offered.

Taking next the third point, protection against piracy and legal controversy. This involves the establishment of a court of conciliation that will stand between the members and the legal sharks that are now thriving on the misunderstandings in the industry. It would also seem logical for a prize or blue ribbon of merit to be offered the manufacturer who is able to make the best improvements in the mechanical construction of his fixtures; and it would also be an ideal arrangement if such improvements could in some manner become the property of the National Council and be used by all its members under some satisfactory working arrangement.

Taking the fourth subject, a better labor plan. This involves the establishment of some method of encouraging the good mechanic, and making it more profitable for the poor mechanic to become more proficient. Also the establishment of some sensible apprentice system to encourage young men to come into the industry. Also plans to encourage invention, and improvement among the workmen, so that they will have a greater direct interest in helping to create better and finer goods. To do this I suggest that we also establish a prize contest that will take in our factory managers, and such of our employes as now manifest a desire to help in the production of better and more workmanlike material.

Franz Brzeczkowski Presents Resolution on Penalty for Piracy.

At a meeting held in New York City on May 18, 1920, the committee considered the question of "Piracy of Design," and the working out of a method by which this objectionable practice may be eliminated. The plan decided upon is embodied in the following resolution:

Whereas, your committee has had under consideration for almost a year the question of eradicating the practice of piracy in the lighting fixture industry; therefore, be it

Resolved, that the following method of procedure shall be adopted and incorporated in the by-laws of our Council:

1. That the Executive Committee of the National Council of Lighting Fixture Manufacturers shall appoint a Board of Conciliation, which shall consist of the president, who shall act as chairman ex-officio, and two members, to serve for the period of one year.
2. This Board of Conciliation is to be empowered by the National Council of Lighting Fixture Manufacturers to review and pass upon all questions of piracy, and to impose such penalties, hereinafter specified, as they shall deem justified. There shall be no appeal from their decisions.
3. Should any member of our organization believe that an act of piracy has been committed against him by an individual, firm or corporation, the method to be adopted by the complainant in entering his complaint shall be to file with the chairman of the Board of Conciliation a written statement, duly sworn to, clearly specifying the cause of complaint.
4. The Board of Conciliation shall thereupon review the charges that have been made, and if they are considered of sufficient gravity to warrant such action, the chairman shall cause to be served upon the individual, firm or corporation accused, a certified copy of the charges, with a written notice that a period of 21 days will be allowed in which to file, with the chairman of the Board of Conciliation, their answer to the charges in the complaint. An extension of this period may be granted at the discretion of the board.
5. The complainant shall submit for the consideration of the board all evidence he may have in his possession, and if he is satisfied that his case has been proved, he can leave it to the board to decide without appearing personally.
6. The accused, upon receipt of his notice from the Board of Conciliation, shall prepare all the evidence at his disposal, and send it to the Board of Conciliation in the form of a sworn affidavit.
7. Both complainant and defendant shall have the privilege of calling witnesses and submitting any evidence they may have that has a bearing on the case.
8. Should the accused fail to submit an answer to the complaint within the twenty-one days, or such extended time as may have been granted, it shall be considered that the charges of the complainant are justified, judgment will be rendered by default, and the Board shall be empowered to inflict such of the penalties hereinafter mentioned as they may consider fair and just.
9. Should either defendant or complainant be unable to appear in person, he may be represented by such member of the Association as he may selected, and as may be acceptable to the Board of Conciliation.
10. In any case coming before it the Board of Conciliation shall consider all evidence, hear all witnesses, then make such decision as seems to them to be fair and just, and, when the charges have been proved, shall impose such penalties as seem to fit the offense.
11. In all cases the cost of arbitration shall be borne by the party against whom the judges decide, and the amount of these costs shall be decided by the judges.
12. The penalties to be imposed shall be as follows:
(a) Reprimand, and demand for apology.
(b) Suspension from the Association.
(c) Suspension of rights, such as exhibiting at the Annual Fixture Show, etc.
(d) Expulsion from the Association.
(e) Publishing the decisions of the Board in the "National Lighting Rays," etc.
(f) Cash fine.

Committee:
Franz Brzeczkowski,
M. D. Blitzer,
George W. Cassidy,
E. T. Caldwell, Chairman.

This is the form of procedure which your Committee recommends shall be adopted and incorporated in the by-laws of the Association.

Your Committee also recommends that when a manufacturer believes that he has a case of piracy against any other member of the Association, he shall first go to see that other member, talk the matter over with him, and see if it is possible to come to an understanding without having recourse to the Board of Conciliation.

Reflections From Leading Lights on Convention Benefits

Illuminating Experts Give Optimistic Expression As to Results to Be Expected From Plans Evolved at Recent Joint Meeting of Men of the Associated Lighting Fixture Industries in Buffalo

By WILLIAM B. EASTWOOD

Men of the Associated Lighting Fixtures Industries will not soon forget their Second Annual Convention and Market at Buffalo. Judging from expressions of leaders in the industry, and from talk among the rank and file, the recent event was productive of more stimulation to the cause of correct illumination than has occurred within the history of electricity. No article from a single mind can so well express the benefits derived from the Buffalo event as does the symposium compiled by ELECTRICAL REVIEW, and presented herewith, from men devoted to the best interests of electrical illumination.

Immediately after the Buffalo convention, Fred R. Farmer, popular president of the National Council of Lighting Fixture Manufacturers, left for the Pacific Coast before a personal expression could be obtained from him as to the results of the Buffalo Market. He is known, however, to have expressed to his immediate associates the feeling that there was about to be a realization of his dreams for years in the establishment of the fixture industry on a plane equal to the other leading industries of the country. He does not feel that the goal has yet been reached, but that even greater good for the industry as a whole will be accomplished this year through co-ordinated effort. Mr. Farmer has also been heard to express the thought that in the fixture industry is to be found a type of men equal in intelligence, initiative and every other particular to those found in any other industry. There is no secret as to his satisfaction in being associated with men who are always ready and willing to respond to an appeal for assistance or advice.

SYMPOSIUM OF INTEREST AND APPRECIATION OF CONVENTION BENEFITS.

Charles H. Hofrichter, secretary-treasurer, National Council of Lighting Fixture Manufacturers, says:

The members of the Executive Committee wish to thank ELECTRICAL REVIEW very much for its cordial co-operation towards putting across the recent convention and Fixture Market at Buffalo, especially the able way in which your Mr. Kennedy handled the Convention Daily. The great success of the Buffalo big event is in no small degree attributable to the publicity given to it by your publication and by the rest of the trade papers.

F. Lee Farmer, department manager, Beardslee Chandelier Manufacturing Co., expresses the following broad views:

In talking to a great many of the dealers who attended the Buffalo convention, I could not help but notice the feeling of friendliness and good will that existed between the dealer and manufacturer, to say nothing of the feeling of good will between the different manufacturers themselves. It seems to me that the dealers, fixture manufacturers and glass manufacturers have come to realize that their problems are all alike and that these three units that make up the lighting fixture industry are not separate and distinct, one sufficient unto himself, or as thought of by some people in the past, competitors, but are only parts of the one industry and dependent on each other. As I heard one dealer express himself in Buffalo, if the story of this convention and fixture market could only be brought home to the dealers who were not there, a wonderful thing would be accomplished.

Would you have thought it possible only a year ago to run a special train from Chicago to Buffalo, carrying 132 representatives of the lighting fixture industry without one single case of murder developing? ELECTRICAL REVIEW and the other trade papers are to be congratulated for the part you and they played in putting this convention and market across.

I feel our big job has been to sell the industry to the members of the industry, and this has been almost accomplished. Next comes selling good lighting and better lighting equipment to the consumer and, because we are sold on the proposition ourselves, this should not be a difficult task if we all do our part.

C. E. Verhunce, general manager, R. Williamson & Co., Chicago, has earned the reputation of initiating a great many good ideas and giving instructive information, but is rather diffident when it comes to talking for publication. He says:

I am afraid that it would be difficult for me to state, with any degree of comprehensiveness, the impressions that were made upon the various representatives of our concern who attended the convention and the benefits derived by our company as a result of the same. Suffice it to say, however, that considered from every angle, I believe this convention and market have been a source of inspiration to all, and it will prove a vital factor in the upbuilding of the entire industry.

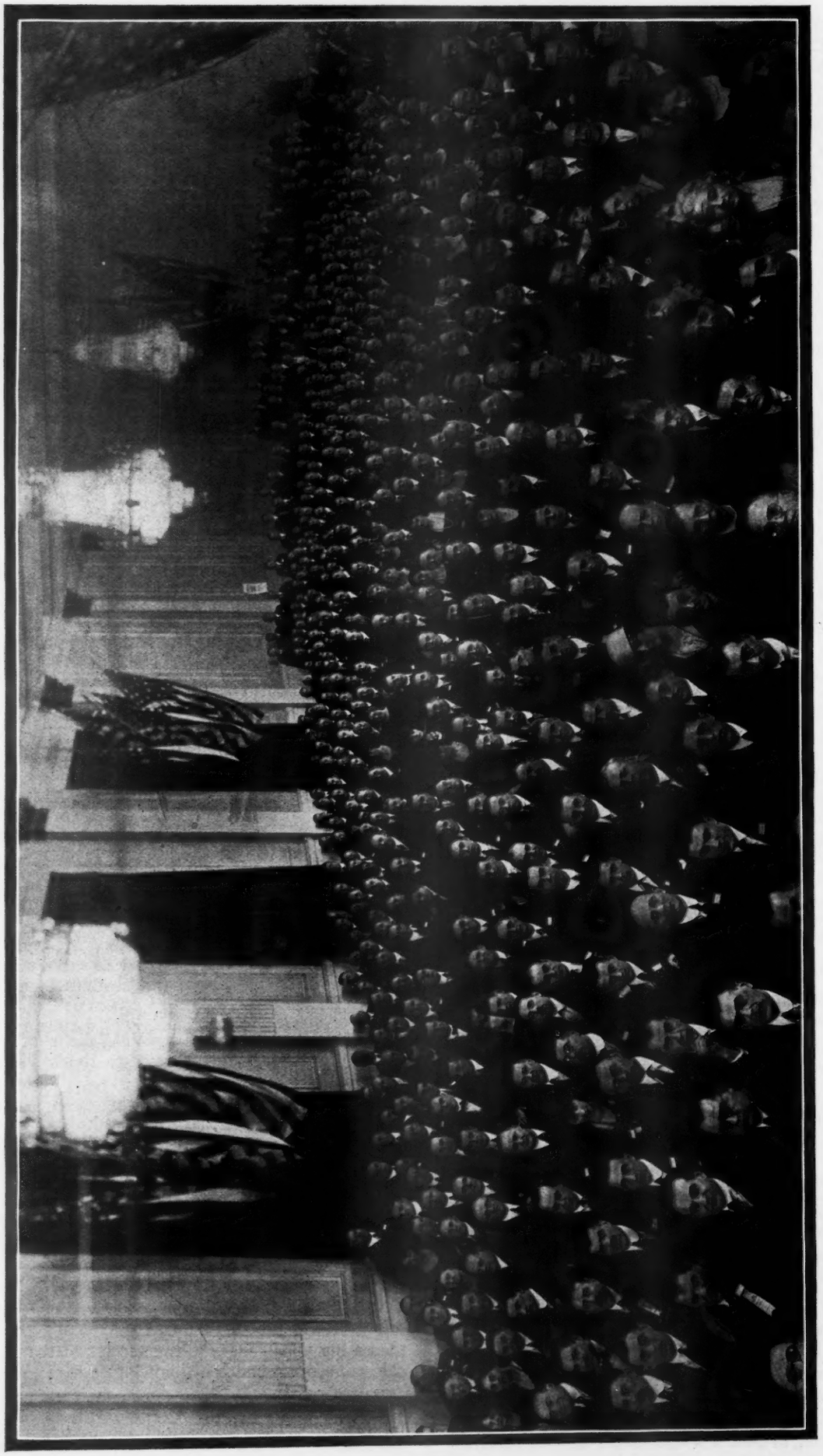
A. F. Wakefield, of the F. W. Wakefield Brass Co., Vermilion, O., gives voice to the following appreciation:

We are glad to say that you will always find the F. W. Wakefield Brass Co. represented at the fixture market and the convention of the National Council. We feel that it exposes our organization to the greatest advances made in the trade besides offering a wonderful opportunity to present our new goods and developments. We are emphatically for it.

The writer would add that President Fred Farmer and Secretary Charles H. Hofrichter are due a great amount of praise for the successful way in which they conducted themselves and the activities of their organization during this event.

Franz Brzeczkowski, president, Moran & Hastings Manufacturing Co., Chicago, who contributed a big man's share to the success of the Buffalo convention, has the following to say:

There is nothing but good can be said of the Buffalo Lighting Fixture Convention. When one looks back to the first get-together meeting of the lighting fixture manufacturers, held a few years ago, and compares it



This Is But One of the Numerous Gatherings of Representatives of the Associated Lighting Fixture Industries at Buffalo During the Joint Convention and Fixture Market. This Particular Gathering Was at the Hotel Lafayette Following a Banquet Feb. 16.

with the meeting held in Buffalo, one can hardly believe that such progress was possible.

In the few years' existence of the National Council of Lighting Fixture Manufacturers there has been an entire change in the feeling of the members toward one another, and we are indeed glad to say that on every hand we find that this turn is one of credit to the industry.

We feel that the officers and board of directors certainly deserve a great deal of credit for the wonderful exhibition that took place in Buffalo, and which was staged without a single mishap of any sort. We feel that at last the lighting fixture business is coming into its own, and there is no doubt but that it will now take its place among the other great industries. In attending these conventions, and we have attended all of them since its foundation, we have noticed a marked improvement in the class of designs being marketed. We surely are strong for the association.

A. Morreau, of the Morreau Co., Cleveland, says:

The exhibits at Buffalo were the best and most modern produced so far. They gave us evidence of thought and new ideas developed during the year of 1920; they gave us proof of the fact that the fixture manufacturers have and are striving to elevate the plane of the fixture industry, and to bring it on a basis to the interest of the industry as well as the user of electric fixtures.

We are trying to educate the public in general to use a better grade of goods which are adapted to the respective locations and in unison with decorations and furnishings of the rooms. In the past no thought was given to this, as a general thing, and we strive to educate the people with modern homes to purchase electroliers, which not only give light, but also beautify the home.

Two main features were brought out at the convention: the adoption of a strict and commonsense plan to do away with piracy and copying of each other's designs, and the re-election of our worthy president, Fred Farmer, who so nobly, diligently and intelligently launched our ship and is steering it so skillfully.

As regards recommendations for our next convention and market, it is well for us to consider the fact that the market and convention do not go well together. The time has been too short and the interest, consequently, too much divided between the meetings and the market. Consequently, the same results could not be effected as were they separated. It will also be very wise to consider as well the city where we meet next, to allow the Western and Southern merchants an easier access to the market.

Edwin B. Gillinder, of Gillinder Brothers, Port Jervis, N. Y., has the following to say:

The convention held in Buffalo, which included also the fixture and glass market, appealed to us to be an unqualified success and a forerunner of a concentration of the entire lighting fixture industry. By such concentration the industry can be placed before the public in a way that will be commensurate with its importance. If the convention can be criticized at all, it would be along the line of too many meetings at the same hour and the inability to be in more than one meeting at the same time.

O. E. Moe, sales manager, Moe-Bridges Co., Milwaukee, makes the following constructive criticism:

Our company was represented at the fixture market and convention in Buffalo by Henrik Moe, C. A. Bridges and myself. We felt that the affair as a whole was a great success from the standpoint of its constructive effect upon the industry. There were certainly a large number of beautiful exhibits which held out some wonderful opportunities for the dealers represented in the way of selecting better assortments for their sales efforts throughout the year. We hope more dealers will come to appreciate this phase of the market in years to come. The convention will undoubtedly result in a great deal of good to the fixture business because of the co-operation of manufacturers in solving our mutual problems.

There is just one point about the market at Buffalo which we think can be improved upon in the future, and that is the policy of throwing the market open to the public. Since the object of the market, as we understand it, is to allow dealers and manufacturers to get together, we believe attendance should be limited to the trade except possibly on one or two evenings. Certainly not during the day nor more than two evenings. Of course, it is important that the business meetings be attended, but if some way can be developed whereby the market will be open for business in the morning as well as in the afternoon, we think it would be advisable.

C. W. Smith, sales manager, National Chain Co., College Point, Long Island, N. Y., views the Buffalo Market from the standpoint of chain manufacture as follows:

We consider the Buffalo Fixture Market a very great success. Unquestionably it tends toward co-operation, which is one of the most necessary features in any industry, and one which has been sadly lacking in the lighting fixture industry.

Our observations concerning the trend of manufacturing, necessarily are made from the viewpoint of chain manufacture. The one or two important things in this line which we notice are: First, the marked tendency on the part of fixture manufacturers to use solid brass chain, instead of steel-plated chain. This we believe is important to the industry, because it means a higher grade product, and higher grade fixtures. Second, the fixture manufacturers are using more care in the selection of the appropriate style of chain for their particular fixture.

Henry Jacob, vice-president, McPhilben Lighting Fixture Co., Queens, N. Y., makes the following suggestions for future conventions and fixture markets:

It is our opinion that it would be advisable to hold the convention 2 or 3 days before the opening of the fixture market so that the representatives of the manufacturers would be able to devote more time to meetings held at conventions at which subjects of common interest can be discussed.

As it worked out at the recent meeting, the manufacturers were handicapped because of the fact that they could not spend as much time with the buyers as they would have liked to because of the interference of the meeting, and the buyers were compelled to waste some of their time because the market was only open for half the time. We think it would have been better for all concerned if the fixture market could have been open all day.

We feel that the attendance at the market was not as great as it might have been in the case of dealers coming from distant points, and think that it might be a rather interesting scheme if an organization could be arranged so that dealers coming to the market could secure a reduction on their fare provided they place orders for some given amount. This might stimulate an attendance which would otherwise not be obtained.

A. Ullman, president, The Scott-Ullman Co., Cleveland, makes the following comment:

Looking at it from every angle, the lighting fixture convention was most successful. While the volume of business taken did not compare with that at Detroit a year ago, it gave the manufacturers a prestige with the dealers who gathered there from all over the country, and without doubt we all will profit from it in the near future.

The efforts put forth by us have given our industry the recognition as an industry, not only by the government, but by every other industry. We can be justly proud, not alone of the progress made as far as the exhibits are concerned, but the constructive work as well.

N. W. Belmuth, treasurer, Shapiro & Aronson, Inc., New York City, says:

The Buffalo Lighting Fixture Market was one of the best ever put over. Our company was pleased with everything that took place, and a great deal of credit

is due to the Buffalo Lighting Fixture Association and all other committees which helped to make it a success.

I might say that the meetings of the National Council of Lighting Fixture Manufacturers and the exhibits were wonderful. The majority of our dealers whom we met at this fixture market were highly impressed with the different lines shown. From a business standpoint we did more than expected, owing to conditions existing. Would like to make the following recommendations for the next fixture market:

Let the first two days be devoted to meetings of both organizations and the remaining days be given entirely to exhibits, so that the dealers may have an opportunity of studying the new lines, and give more time to the manufacturers. The evenings are to be devoted to the public.

We found through our experience at the Buffalo Lighting Fixture Market, that by allowing the public to attend there was considerable interest shown by them and we turned over quite a few people who were interested in fixtures shown, to our customers. The only fault we found was that our dealers did not have enough time to examine the exhibits. We trust that the organizations will look forward to changing this condition at the next convention.

Norman B. Hickox, sales manager, National X-Ray Reflector Co., Chicago, does not overlook a tribute to William L. Goodwin in the following expression:

As a result of the fixture market I have been very much impressed with the progress our industry is making. The show must have been a big success, even if immediate orders were not booked in a volume such as might have been desired.

Personally, it is my opinion that Mr. Goodwin expressed the keynote which indicates future progress when he said, "The fixture manufacturer must teach his designer utilization, and for future progress lighting fixtures must first be designed by engineers for producing proper illumination, to which the artist must then add his decorative scheme."

E. Schwartz, of the Robert Findlay Manufacturing Co., Inc., New York City, says:

We will say that the convention was a total success, admirable in every way, and hope that the next convention and fixture market will be equally as successful.

C. H. Blumenauer, president, The Jefferson Glass Co., Follansbee, W. Va., one of the strong factors for co-operation in the industry, very well expresses the feelings of many others in the following:

We feel very certain that the lighting fixture market and convention held in Buffalo can be fully considered as entirely successful—not altogether from a commercial point of view because, as might have been expected, due to the conditions, sales of merchandise were not exceedingly large, but probably more safely sold than was the experience at the Detroit market the previous year—but because of the cementing of the acquaintanceship and consequent co-operation of the three allied branches of this industry.

Without doubt, the keynote of business today is co-operation and a clearer understanding of all concerned and which relieves the industry of many disturbances, misunderstandings and losses. We are very glad it was our privilege to join in the convention work and to have an exhibit and we consider the time and money exceedingly well spent, but again, mostly because of the friendly feeling that was secured.

It is our opinion that the market and the convention should be divided. There is quite an expense involved in exhibiting at a market, and there should be no restriction in the market opportunities for sales. We have in mind the great successful fairs at Leipsic and Lyons, which are devoted solely to the exhibition and sale of products.

Arthur Polacheck, president-treasurer, Chas. Polacheck & Bro. Co., Milwaukee, let everybody know that he was at the Buffalo Market and that his two chief aims in life were to stimulate the lighting industry and obtain the next convention and market for Milwaukee. Having felt that he has said and done—and is continuing to do—sufficient about the Buffalo event to let everybody know where he stands on that question, he has devoted the following entirely to the subject, "Milwaukee":

The Milwaukee Chandelier Men's Association has a total membership of 12, which is practically all of the representative houses in Milwaukee. There are a few small dealers, and we are trying to interest them and hope to have everyone in our membership who is at all connected with this business. I think that in comparison in size, Milwaukee has as large a membership in its association as any city in the country. Our members are all very enthusiastic about their association, and to prove it they were all at the Buffalo convention, some firms being represented by two or even three persons.

Our meetings at luncheon on Tuesdays of each week are well attended and many interesting topics are discussed in a friendly way, and generally with good results. We are gradually eliminating such evils as the copying of designs and the coaxing away of help and the cutting of prices to an unreasonable extent. Through the closer acquaintance that was brought about, we feel that the business has been placed on a higher plane and that it has become a real business and one that anyone could be proud to be connected with.

The copying of each other's designs has been entirely eliminated and the former practice of being anxious and eager to give bids on the designs furnished by others is being thoroughly discouraged. In fact, we are getting closer and closer to applying the Golden Rule to our methods of doing business, and the results have been very gratifying. Everyone has plenty to do when there is any business at all, and better still, everyone is fairly prosperous.

We are also able to arrange matters pertaining to our labor, through conferences that we have, where we discuss these difficulties and are able to get them settled satisfactorily. In addition to this is the willingness shown to help each other with material and to give information regarding desirability of applicants for positions. In fact, they treat each other on the square. Taking all of this into consideration, I feel that our Milwaukee Association has proven to be a success and will continue to thrive and prosper.

Now about Milwaukee itself. The Milwaukee delegation to the fixture market consisted of 18 persons, the most complete representation that has ever attended any trade gathering of our line of business, and this certainly speaks well of the interest that we all have in this great organization.

You all know that for ages Milwaukee was famous as the town where the beer was. Everyone greeted us with "Hello, Schlitz," or "Blue Ribbon"; but the days of Milwaukee's greatness on this account are over. All this is now a matter of history and would be forgotten excepting that now there has arisen a new star, and the Milwaukee Lighting Fixture Association is going to put Milwaukee on the map again.

For the purpose of acquainting all of you with the many advantages that Milwaukee still has and also to show you the hospitality for which it is proverbial, on behalf of our local association, I am authorized to invite all of you to come to Milwaukee for your next fixture market. Milwaukee bids you welcome.

Gabriel B. Levy, president, Brandt-Dent Co., Watertown, Wis., manifests his interested approval of the Buffalo Market, and appreciation of the work of officers and fellow manufacturers in the following terms:

The Lighting Fixture show is now an institution. It seems almost incredible that the officers of the National Council and their co-workers could bring the show to such a standard of perfection. Its completeness and thoroughness made it seem like a 20th annual show instead of the second one. And these same officers and hustlers are already on the "warpath" for new ideas and improvements for next year. Good luck to them. We congratulate them on the results.

EDITORIAL COMMENT

Individual and Collective Opportunities

Not so very long ago some men whose business is that of testing the human sight and selling glasses for correction of impaired vision entered upon a collective campaign of publicity in Indianapolis. They bought liberally of space in the newspapers and ran startling advertisements warning people against neglect of their eyes. They pointed out dire consequence of such neglect and urged those with defective vision to "consult an optometrist at once and obtain corrective lenses to save the eyes."

It so happened that an electrical dealer in the same city saw in the campaign of the optometrists an opportunity which could be turned to his own account. It involved, however, the stealing of some of the other fellow's thunder. While the eyeglass campaign was in full swing the electrical dealer bought some newspaper space next to that of the optometrists—not nearly so large, but amply sufficient for his purpose, as it proved. The smaller advertisement read:

"You need not fear failing eyesight, and you will never need eyeglasses if you have the right illumination in your home, office and workshop. Good illumination is cheaper than doctors and eyeglasses. Let us install your lights while your eyesight is still good." The name and address of the electrical dealer followed.

That was a case of grasping individual opportunity. It serves to illustrate one of the results of the great co-operative movement which is now stimulating the entire electrical industry.

Not so very long ago the producers of electrical energy, the manufacturers of electrical appliances and the electrical contractor-dealers listened to the advice of able minds and the associations representing these three branches grasped the opportunity of co-operating in the education of the public to the greater advantages of electricity for lighting and power. This campaign is now at its zenith and is beginning to bear fruitful results. One of its manifestations may be seen in the waning antagonism of the public toward utilities.

Just the other day there gathered in Buffalo in joint convention three other associations representing another branch of the electrical industry —lighting fixtures. Like the central-station companies, the appliance manufacturers and the contractor-dealers, the promoters of better illumination grasped the opportunity for better business through collective efforts. This gathering, in addition to uniting every branch of the electrical industry in a concerted movement for better conditions, indeliby impressed the fixture men with the greater possibilities for business through collective action and co-operation with the other branches.

The ELECTRICAL REVIEW is proud to have participated prominently in this event which completes the unity of the electrical industry. Members of the editorial staff of this publication had the privilege of conducting the *National Lighting Rays* Convention Daily throughout the Buffalo Market, sharing in the enthusiasm and success which marked the fruition of a great opportunity.

Wiring For Window Illumination

A systematic study of the science of artificial lighting usually includes a number of matters other than those relating directly to the light source itself. It appears, though, that there is one subject which is not, as a rule, given as much thought by those engaged in the study of problems in illumination and in teaching others what is best in the art, as it should be. This subject has to do with the design of circuits for supplying power to lamps and for the control of lights after an installation has been completed. To the practical man whose duties include the design of lighting schemes of the commoner types, nothing is of greater importance than a thorough knowledge of what can be done in the way of arranging switches for the most convenient control of lights and of supplying proper and adequate outlets and receptacles to meet present needs and to insure that the circuits may be readily adjusted to meet any ordinary changes in the lighting service which may subsequently become desirable.

Ignorance and carelessness in the matter just mentioned sometimes lead to some very awkward and annoying conditions in show-window lighting. The designer of the lighting scheme for a given window often satisfies himself with a scheme of illumination sufficient to fulfill requirements then existing and those easily seen to be probable, and the wiring is done accordingly. Then, when some unforeseen demand for extra current in the window arises, the wiring is found to be inadequate and unsatisfactory.

In the wiring of windows to be used in the display of merchandise there should not only be

provided a liberal supply of properly located sockets for lamps, when the wiring is installed, but, in most cases, it is also well worth while to provide sufficient receptacles for attachment plugs. In the average window there is liable to be, at almost any time, a demand for special lighting which makes the presence of such receptacles highly essential. Moreover, aside from the lighting, the desire to employ fans or other special apparatus is always liable to make receptacles necessary. Where local rules permit, and where conditions seem to justify such procedure, it might be well to install the so-called 1320-watt window-lighting circuits with extra circuits for the connection of special lighting and motor-operated display equipment.

Planning Residence Wiring

When the plans for a new residence are being laid out, and even when the building is well under way, it is often uncertain as to what the furnishing of the various rooms may be and what kind of artificial illumination will be needed or desired. While it may be necessary to determine upon the position of the outlets for the electric wiring, the details of the lighting cannot always be determined. Of course, it is good practice to design the complete interior, including the lighting scheme, before the other plans are completed, but it is nevertheless a fact that this is not always done, and indeed it sometimes would be out of the question.

It consequently behooves the architect, or, if it falls to his decision, the electrical contractor, to see to it that provision in the electric wiring is made for all possibilities and that outlets are provided, not merely for regulation ceiling fixtures, but for baseboards and floor outlets for supplying table lamps, etc. This applies not only to residences, but also to hotels and a variety of other structures. Not only are different possibilities in the lighting equipment to be considered, but the eventuality must be kept in mind of using various kinds of labor-saving and convenience devices, including kitchen and laundry appliances, vacuum cleaners, fans, etc.

Provision in the electric wiring for such contingencies as this represents a measure and a kind of preparedness which both architect and electrical contractor may well keep in mind.

International Industrial Lighting Code

At a meeting of the Illuminating Engineering Society, in London, L. Gaster read a paper on industrial lighting in relation to health and safety and the opportunity was taken to point out the desirability of international agreement on the principles of industrial lighting for ultimate application in an international "code" on factory lighting. The International Labor Office of the League of Nations in Geneva is already, through its section in industrial hygiene, interesting itself in the question of factory lighting. Much attention has also been given to industrial lighting as an aid to safety, notably at the first conference organized by the British Industrial "Safety First" Congress held in London in September. A recent step has been the formation, under the British Ministry of Health, of a committee to inquire into the causes of blindness and defective vision and it is hoped that inadequate lighting will receive attention as one of the contributory causes of such eyesight trouble.

This is co-operative effort having practical interest to the American and Canadian readers of ELECTRICAL REVIEW, as well as to many of its subscribers in other industrial countries, and reports on it will be printed from time to time as developments of importance occur.

Railway Electrification in France

The condition of industry in France since the war has been far from satisfactory. The unfortunate situation resulting from the world conflict is aggravated by the insufficiency of the coal production, large orders for coal having to be placed with foreign countries. The attention of engineers is thus naturally directed to the hydraulic resources of the country, amounting to about 10,000,000 hp., which, it is estimated, would effect a saving of something in excess of 30,000,000 tons of coal annually.

M. M. H. Schuhler and M. Lambert have made a study of the present situation and state that a more economical utilization of natural water-power sites necessitates more railway lines on which the traffic is heavy and continuous, or, alternatively, lines with variable and steep grades. They conclude that certain main lines in the South of France are of such a nature that they can be operated economically by conversion from steam to electricity. At the present time, and under the peculiar conditions resulting from the war, no electrification is recommended where the energy would have to be produced by the combustion of coal. Thus, out of a total of about 25,000 mi. of state railways, only 5000 mi. of line are under discussion in regard to possible electrification.

Although the electrification of these lines represents a formidable undertaking, and involves an enormous capital expenditure, the authors of the report referred to believe that the economy of operation—including savings in coal, salaries and wages—is such as to justify the change.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

THREE ILLINOIS ASSOCIATIONS TO MEET JOINTLY.

Consumers' Stewardship of Coal Deposits and Customer Accounting Among Subjects to Be Discussed at Chicago Gathering Next Week.

The program for the joint meeting next week of the Illinois State Electric Association, the Illinois Electric Railways Association, and the Illinois Gas Association covers many important subjects, among which may be mentioned "Financing Through Your Customers," "Comparative Cost of Producing Power by Isolated Plants vs. Central Station Under Present Conditions" and "Hazards of Faulty Switchboard Construction."

The various business sessions will be held in the Hotel Sherman, Chicago, March 15-16, with a banquet on Wednesday evening. The program for the business sessions of the electric section follows:

March 15, 10 a. m.—Address by W. M. Willett, president of the Illinois Gas Association; Auditing Committee's report, by E. H. Negley, Canton Gas & Electric Co.; secretary-treasurer's report, by R. V. Prather; appointment of convention committees; address on "Financing Through Your Customers," by John F. Gilchrist, vice-president of the Commonwealth Edison Co.

March 15, 2 p. m.—Addresses on "The Consumers' Stewardship of the Coal Deposits," by W. L. Abbott, chief operating engineer of the Commonwealth Edison Co.; "Customer Accounting," by J. H. Thomas, Central Illinois Light Co., and "Methods of Measuring Reactive Component and Apparent Power for Basis of Rate Making," by Ray H. Wolford, assistant engineer of the meter department, American Gas & Electric Co.

March 16, 10 a. m.—Addresses on "What the National Associations Are Doing," by Martin J. Insull, president of the National Electric Light Association; Charles H. Munroe, president of the American Gas Association, and Philip H. Gadsden, president of the American Electric Railways Association; report of convention committees.

March 16, 2 p. m.—Addresses on "Comparative Cost of Producing Power by Isolated Plants vs. Central Station Under Present Conditions," by John H. Mitchell, new business manager of the East St. Louis Light & Power Co.; "Testing of Instrument Transformers," by F. A. Kartak, professor of electrical engineering, School of Engineering of Milwaukee, and "Hazards of Faulty Switchboard Construction," by R. M. Bert, electrical superintendent of the Rockford Electric Co.

MANUFACTURERS TO HEAR TALKS ON OPERATING COSTS.

Problems Relating to the Expenses of Industrial Production to Be Elucidated by Secretary of Industrial Cost Association.

A. A. Alles, Jr., executive secretary of the Industrial Cost Association, Peoples Bank building, Pittsburgh, has been invited to address the manufacturers on the necessity for true production costs. Owing to the importance of the subject it has been decided to have Mr. Alles address the local associations independently and invitations have been extended to him by Chicago, Cleveland, Philadelphia and New York. In speaking of the Industrial Cost Association Mr. Alles said:

"On every side we hear the solution of present industrial problems is lower production costs. It is, however, one thing to say it and another to do it. Very few manufacturers know their true costs—the Federal Trade Commission says less than 5% of 260,000 industrial concerns investigated actually know their costs, and over 75% are merely breaking even or actually losing money. The remaining 20% manage somehow to make some money without knowing their costs.

"Membership is extended to officers and managers and cost executives of industrial concerns. The Association is a co-operative effort backed by leading trade associations and other bodies and the members are pledged to assist one another in the solution of their cost problems. It is a Delaware corporation having no capital stock and is not organized for profit. The annual dues are $25.

"Among the present members are: L. Plaut & Co., American Chain Co., J. L. Mott & Co., Armour & Co., American Rolling Mills Co., Bethlehem Steel Co., Borden's Farm Products Co., General Electric Co., Morse Chain Co., New Jersey Zinc Co., Universal Portland Cement Co., Westinghouse Air Brake Co., etc."

Further information may be secured or arrangements for addressing local associations made by writing Mr. Alles.

FROGRESS MADE BY INDUSTRIAL LIGHTING EXHIBIT.

Latest and Efficient Means of Illumination Demonstrated by Exhibit Which Attracts Marked Interest in Cities Where Shown.

Recent reports show that approximately 4000 persons have attended the industrial lighting exhibit that has been shown under the auspices of the Edison Lamp Works of General Electric Co. in about 25 cities of the country since the first of the year to demonstrate the value of efficient and industrial lighting systems. The figures show that about 25% of those attending are executives of industrial plants, including presidents, vice-presidents, secretaries, treasurers, purchasing agents and general superintendents. Ten per cent are foremen, electricians and superintendents, and 10% (exclusive of the executives mentioned) are representatives of civic organizations, such as boards of trade, chambers of commerce, manufacturers' associations, Kiwanis and Rotary clubs. The remaining 5% comprises architects, engineers, teachers, students, etc. Contractors, dealers, central-station men and jobbers' salesmen are also among those attending. Representatives of the principal industries of each city, as well as

merchants and others, are included in the audiences, thus bringing the exhibit into touch with a great variety of different industrial and business lines. In some cities, labor department inspectors are noted as among those attending.

The audiences uniformly expressed themselves as greatly interested and as having learned much about illumination. In many cases they remain after the demonstration and lecture to discuss with the demonstrator lighting problems in which they are personally interested. While the purpose of the exhibit is broadly educational, rather than an attempt to promote the sale of specific products, prospects for new installations have been lined up in several cities immediately following the demonstration as a direct result of the exhibit.

The demonstrations are given in a portable booth which seats 50 persons at a time and which is equipped with the latest and most modern types of lighting devices, as well as specimens of obsolete and poorly arranged kinds, thereby affording a comparison between the two. In addition, those attending are furnished foot-candle meters with which they measure for themselves the intensity of illumination produced by different types shown. Stress is laid on the fact that better illumination means fewer accidents, increased production and a better quality of workmanship.

ELECTRICALLY EQUIPPED HOME AS A SILENT SALESMAN.

A modern apartment equipped with all known electrical labor-saving appliances and tending to put the home on a parity with the well appointed office, will be operated by the Queensboro Corp. at Elmhurst (Jackson Heights), Long Island, N. Y., as a practical illustration of how the housewife in performing her daily work and ministering to the comfort of the family may advantageously enlist the services of electricity. The furnishings and the 50-odd electrical devices displayed are the results of the co-operative work of over 20 leading manufacturers of electrical equipment and the New York department store of Gimbel Bros.

EFFORTS TO ABOLISH CORPORATION COMMISSION FAIL.

Recent advices from Oklahoma City, Okla., are to the effect that members of the state senate who oppose the continuance of the Oklahoma Corporation Commission, and who would transfer jurisdiction over rates of public service companies and public utilities to the courts, fought for 3 days in an effort to strike out appropriations vital to the Corporation Commission in connection with the budget bill providing funds for the various state departments. A substantial majority of the senate, however, voted to continue appropriations for state regulation. When consideration of the departmental appropriations bill was completed and it was advanced to third reading it was found that the senate had not only approved the items carried in the bill, but had increased the total appropriation for the Commission over the amount reported by the appropriations committee.

Senators who attacked the Commission claimed that it had done little but increase rates and had failed to function in the interests of the people. Senate leaders who opposed abolishing the appropriations for the Commission declared that if it was deprived of funds there would remain nobody in the state to regulate rates of public utilities, as nothing was proposed to take the place of the Commission. It was pointed out that the system of state control had been adopted by most of the states because of the complexity of modern utility service and the unwillingness of courts to examine into the multitude of facts necessary as a preliminary to an intelligent fixing of rates.

DECEMBER EXPORT OF ELECTRICAL GOODS SHOW INCREASE.

Total Amounts to $13,812,251; Increase of $7,146,591 Compared With Same Month Last Year—Total Year's Figures Are $101,990,075.

The exports of electrical goods to foreign countries for December were valued at $13,812,251, compared with $6,665,660 for the corresponding month in 1919, or an increase of $7,146,591. For the 12 mo. ending December, 1920, the total exports amounted to $101,990,075, an increase of $12,900,364 over the 1919 figures and an increase of $42,006,469 over the total for the 12 mo. ending December, 1918.

The following classified figures give the detailed data for December, 1920, compared with the corresponding month for the previous year:

Electrical machinery and appliances (except locomotives):	Dec., 1919.	Dec., 1920.
Batteries	$ 477,102	$ 649,769
Carbons	100,946	123,793
Dynamos and generators	583,025	1,487,543
Fans	32,648	257,432
Heating and cooking apparatus	110,575	206,548
Insulated wire and cables	499,315	1,301,307
Interior wiring supplies, including fixtures	245,434	442,129
Lamps—		
Arc	1,031	2,893
Incandescent—		
Carbon filament	16,678	19,622
Metal filament	311,308	463,487
Magnetos, spark plugs, etc.	232,762	314,185
Meters and measuring instruments	227,955	332,314
Motors	778,039	1,702,846
Rheostats and controllers	35,836	81,569
Switches and accessories	216,020	568,343
Telegraph apparatus, including wireless	41,767	101,605
Telephones	330,223	544,068
Transformers	297,869	696,057
All other	2,127,127	4,516,741
Total electrical machinery, etc.	$6,665,660	$13,812,251

ELECTRICAL SUPPLY JOBBERS PLAN INTERESTING MEETING.

Two interesting sessions are planned for the regular quarterly meeting of the Atlantic Division of the Electrical Supply Jobbers' Association to be held in the Hotel Commodore, New York City, March 15.

In addition to the election of a new division chairman to succeed A. M. Little, president of the Mohawk Electrical Supply Co., Syracuse, N. Y., who recently resigned, and discussion in executive session whether or not qualifications for membership in the association should be modified to admit smaller jobbers, W. I. Bickford, Iron City Electric Co., Pittsburgh, will speak on "Necessity for Maintaining Stocks for Service Under All Conditions." Other speakers will be W. L. Goodwin, recently appointed assistant to the president of the Society for Electrical Development, and Charles L. Eidlitz, president of the R. B.

Corey Co., New York City, who will tell the jobber "How to Sell the Contractor." Secretary E. Donald Tolles will report on his investigation of recording systems employed in the receiving, shipping and charging departments of a number of jobbing houses.

ELECTRICAL INDUSTRY INTERESTED IN CONFERENCE.

In Washington, D. C., the attendance at the Merchandising Conference held under the auspices of the General Electric Co., and eight concerns allied or affiliated with it, was 350. At Jacksonville it was 275, and at New Orleans, 300. Similar attendances are reported from other cities where the conferences are now being held. A large number of jobbers, dealers and salesmen have already been reached, the total number during the first itinerary being estimated at 6000. Nine cities were visited on the first itinerary, and the second, now in progress, includes 12. By the time the itineraries are completed, the principal distributing points in the electrical field will have been visited and jobbers, dealers and salesmen of every section of the country brought into contact with the enterprise.

Reports indicate that the conferences are inspiring much interest among those who attend. It is conducted on the basis of promoting the welfare of the electrical trades as a whole rather than of pushing particular products, and has been pronounced an effective and practical means for stimulating activity in this field.

DISCUSS UTILITY SECURITIES AT ELECTRIC CLUB LUNCHEON.

The subject of "Utility Securities From the Owners' Standpoint" was discussed by Charles Munroe at the regular weekly luncheon of the Electric Club of Chicago held March 8. The speaker said that public utilities provide a more stable investment than any other type of securities excepting government bonds. He further declared that in spite of increased prices during the last 6 yrs. very few public utilities have defaulted on their bond issues and most of them paid a substantial dividend to their shareholders.

CIVIL SERVICE EXAMINATION FOR RADIO AID.

The U. S. Civil Service Commission has announced an open competitive examination for radio aid, applications to close March 29. The duties of the appointee will be to carry on research, design and development of radio apparatus; to supervise the installation and operation of radio apparatus in accordance with standard plans and specifications; to prepare such standard plans and specifications after being informed as to naval policies and regulations; to analyze the data obtained from the operation of radio installations, and make recommendations as to policy, apparatus or installation, in accordance therewith; to inspect radio stations on shore and ship and make necessary advanced radio measurements, and in general to carry on advanced technical work in radio research, design and development and practical work in the construction, installation and repair of radio apparatus. The appointee must be capable of preparing a clear, concise, engineering report of inspection, test and research work. Those desiring to make application should write to the commission, Washington, D. C., asking for form 2118 and mentioning the title of the examination desired.

A. I. E. E. AND A. I. S. E. E. TO HOLD JOINT MEETING.

The new Colfax station of the Duquesne Light Co. will be the main subject of a joint meeting of the American Institute of Electrical Engineers and the Association of Iron and Steel Electrical Engineers, which will be held in Pittsburgh, April 16. During the morning of the meeting the Colfax station will be visited in order to review the new 60,000-kw., 3-cylinder cross-compound Westinghouse turbine-generator. The ultimate capacity of this plant is to be 360,000 kw.

Papers will be presented by D. L. Galusha on the electrical features, and by C. E. W. Clarke on the mechanical features of this station. B. G. Lamme, chief engineer of the Westinghouse Electric & Manufacturing Co., will read a paper entitled "The Problem of Conversion from 60 Cycles to 25 Cycles," and D. M. Petty, of the Bethlehem Steel Co., will give a talk on "Some Results in the Changing of 60 Cycles to 25 Cycles." A. W. Berresford, president of the American Institute of Electrical Engineers, and E. S. Jefferies, president of the Association of Iron and Steel Electrical Engineers, will preside at the meeting.

ROCHESTER SECTION, A. I. E. E., HOLDS MEETING.

"The Engineering Application of Electricity to the Automobile" was the subject discussed at the 51st meeting of the Rochester (N. Y.) Section of the American Institute of Electrical Engineers. The speaker was G. R. Fessenden, service engineer of the North East Electric Co., who illustrated his talk on the general application of electricity to the automobile with two films of motion pictures, one of which covered the starting and lighting systems and the other the ignition system. In the pictures animated diagrams were employed to show the various electrical units performing their functions.

NEW PUBLIC UTILITY COMMISSION LAW FOR NEW JERSEY.

Following the veto of Governor Edwards of New Jersey of the Wallworth bill creating a new public utility commission of three members, the legislature has approved the measure for a second time, thus making it a law. The bill provides for a salary of $12,000 a year for each of the three commissioners. It calls for the appointment by the governor of one member for a term of 2 yrs., another for 4 yrs., and a third for 6 yrs., and thereafter each term to be 6 yrs. It eliminates the clause in the former law conferring the power upon the governor to remove the members from office for cause; this authority is denied. The former utility board of the state was composed of five members, each receiving $7500 per annum.

This board, as previously announced, was removed by Governor Edwards, and he will now have the privilege of appointing three new members for the state commission.

I. E. S. DISCUSSES LIGHTING OF COMMON CARRIERS.

"Lighting of Common Carriers" was the subject discussed at the joint meeting March 10 of the New York section of the Illuminating Engineering Society with railway electrical engineers and public service commission representatives. Papers on "Lighting of Railway Coaches," by J. L. Minick, Pennsylvania Railroad Co.; "Lighting of Electric Railway and Subway Cars," by J. A. Summers, Edison Lamp Works of General Electric Co., and "Lighting of Jitney Buses," by L. C. Porter and R. W. Jordan, Edison Lamp Works of General Electric Co., were presented.

DISCUSS NIAGARA FALLS POWER.

The Pittsburgh section of the American Institute of Electrical Engineers discussed at its meeting March 8 the recent 100,000-hp. development of the Niagara Falls Power Co. J. Allen Johnson, electrical engineer of the company, spoke on the electrical features of the project, and F. D. Newbury, manager of the Power Engineering department, Westinghouse Electric & Manufacturing Co., covered the subject of the generating equipment of the Niagara Falls plant. Colored moving pictures illustrating the construction work on this development were also presented.

CONSULTING ENGINEERS ORGANIZE IN CHICAGO.

In order to act as a unit in matters of common interest, a number of consulting engineers engaged in electrical, mechanical and sanitary engineering practice in Chicago have organized the Chicago Association of Consulting Engineers. This new association has set itself the task of improving existing conditions and eliminating practices that might be open to criticism. The charter members of the association are J. B. Lund, H. A. Durr, C. G. Atkins, C. D. Allan, I. E. Brooke, E. V. Lippe, G. A. Muir, F. J. Postel, P. T. Potter and J. D. Small. Mr. Lund has been chosen as president and Mr. Durr as secretary-treasurer of the organization.

RADIO ENGINEERS MEET.

At the March 2 meeting of the Institute of Radio Engineers in the Engineering Societies building, New York City, a paper on "Piloting Vessels by Electrically Energized Cables" was presented by A. Crossley, the paper being illustrated by sildes and moving pictures of actual tests of the system, which is one of the latest electrical signaling aids to navigation.

RAILWAY FUEL MEN TO MEET.

Announcement has been made by J. G. Crawford, secretary-treasurer of the International Railway Fuel Association, that the 13th annual meeting of the Association will be held May 24-26, at the Hotel Sherman, Chicago.

COMING CONVENTIONS.

Associated Manufacturers of Electrical Supplies. Annual convention, New York City, March 15. Headquarters, 30 East 42d street, New York City. General secretary, Charles E. Dustin, Hartford, Conn.

Electrical Supply Jobbers' Association. Quarterly meeting of Atlantic Division, New York City, March 15. Headquarters, Hotel Commodore. Secretary, E. Donald Tolles, 52 Broadway, New York City.

Joint meeting of Illinois State Electric Association, Illinois Electric Railways Association and Illinois Gas Association, Chicago, March 15-17. Headquarters, Sherman House. Secretary, R. V. Prather, Springfield, Ill.

American Washing Machine Manufacturers' Association. Meeting at Sherman Hotel, Chicago, March 16-17. Secretary, Enoch B. Seitz, Otis building, Chicago.

Wisconsin Electrical Association. Annual convention, Milwaukee, March 22-24, jointly with the Wisconsin Gas Association. Secretary, J. P. Pulliam, 1408 First Wisconsin National Bank building, Milwaukee.

Kansas City Electrical Show. First annual electrical exposition, Convention Hall, Kansas City, Mo., April 18-23. Manager, Sam Furst, Electrical Trades Exposition Co., 802 Broadway, Kansas City, Mo.

American Electrochemical Society. Spring meeting, Atlantic City, N. J., April 21-23. Headquarters, Hotel Chalfonte. Secretary, Joseph W. Richards, Lehigh University, Bethlehem, Pa.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 18-21. Headquarters, Hotel Galvez. Secretary, H. S. Cooper, 403 Slaughter building, Dallas, Tex.

American Society of Mechanical Engineers. Spring meeting, Chicago, May 23-26. Headquarters, Congress Hotel. Assistant secretary, C. E. Davies, 29 West 39th street, New York City.

International Railway Fuel Association. Annual convention, Chicago, May 24-26. Headquarters, Hotel Sherman. Secretary, J. G. Crawford, 702 East 51st street, Chicago.

Electrical Supply Jobbers' Association. Thirteenth annual meeting, Hot Springs, Va., May 25-27. Headquarters, The Homestead. General secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Pacific Coast Geographic Division of the National Electric Light Association. Annual convention, Del Monte, Cal., May 25-27. Headquarters, Hotel Del Monte. Secretary, L. H. Newbert, 445 Sutter street, San Francisco.

National Electrical Light Association. Annual convention, Chicago, May 31-June 3. Headquarters, Drake Hotel. Executive manager, M. H. Aylesworth, 29 West 39th street, New York City.

North Central Electric Association. Annual convention, Duluth, Minn., June 14-16. Secretary, H. E. Young, 15 South Fifth street, Minneapolis, Minn.

Tri-State Water and Light Association. Annual convention, Asheville, N. C., June 15-16. Secretary, W. F. Steiglitz, Columbia, S. C.

National Fire Protection Association. Annual convention, San Francisco, June 14-16. Secretary, Franklin H. Wentworth, 87 Milk street, Boston.

Canadian Electrical Association. Annual convention, Quebec City, June 15-17. Secretary, Eugene Vinet, Power building, Montreal, Que.

American Institute of Electrical Engineers. Annual convention jointly with the Pacific Coast convention, Salt Lake City, Utah, June 20-25. Secretary, F. L. Hutchinson, 33 West 39th street, New York City.

North Central Geographic Division of the National Electric Light Association. Next convention, Duluth, Minn., June 21-23. Headquarters, Spaulding Hotel. Secretary, H. E. Young, 15 South Fifth street, Minneapolis, Minn.

National Association of Electrical Contractors and Dealers, Anniversary convention, Buffalo, N. Y., July 20. Secretary, W. H. Morton, 110 West 40th street, New York City.

CONTRACTOR-DEALER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-keeping for the Dealer in Electrical Goods

DEVELOPMENT OF THE ELECTRICAL INDUSTRY IN 1921.

Electrical Industry Urged to Concentrate Its Efforts on Home-Building—Paper Before Electrical Contractor-Dealers of Ohio.

By Frank D. Van Winkle,
Post-Glover Electric Co., Cincinnati.

The beginning of this year showed a strangely unbalanced market condition, with copper, rubber and hides selling below the lowest quotations for 1914, and fuel costs advanced 100% over the same period, brick at 160%, paper 180% and pig iron nearly 200%. Other materials, such as leather, cotton, wool and foodstuffs, which have not declined to the same extent as copper and rubber, continue to record new low levels and have now practically reached the actual cost of production. The present market conditions have been brought about by what amounts to a strike on the part of the buying public, and as fuel and iron are the bases of practically every industry there can hardly be any important revival of business activity until these commodities have reached a level at which the investor feels justified in proceeding.

During the war industrial development proceeded at three times the average rate, and as the result we now have in this country and Canada two factory buildings for every one which existed in 1914. Probably 5 yrs. will elapse before the normal development of the country will overtake the buildings of this kind already equipped and under roof. As a result the electrical trade should concentrate its thoughts on home-building, of which our normal requirements are about 350,000 per year. During 1919 less than 70,000 residences were constructed, and the record for 1920 will probably show a less number. The shortage since the beginning of the war is over 1,000,000 buildings for residence purposes. Even a reasonable amount of business activity, coupled with lower cost for basic materials, should mark the beginning of a home-building campaign. The price of lumber encourages the belief that the time may not be far away.

With the increased use of farm-lighting outfits and the spreading out of high-potential rural lines, practically every home becomes a possible user of electric light and power. Intensive effort on the part of individual companies, as well as the associations which have been formed to spread the knowledge of the uses of electricity, will fill many of the valleys which might otherwise exist in our industry. Another point which is not to be overlooked is that the rapidly diminishing supply of natural gas will open up a tremendous market for electric stoves and heating appliances where the low price of fuel gas has heretofore stood in the way. This, coupled with the increasing cost of fuel transportation, makes for a brighter outlook for every member of our industry—central station, manufacturer, jobber and contractor.

Another great opportunity exists for electrical contractors and dealers in replacing farm or portable electrical sets on farms and in rural communities with service from high-tension lines. Whenever a battery goes to pieces the farmer naturally looks around for the nearest "high" line from which he can take service. The farm-lighting outfit proves an excellent teaser and the user becomes a potential prospect for regular service. Electrical contractors and dealers should watch for such opportunities. Labor has increased consistently with civilization and history proves that labor has never come down in cost. There may be some slight reductions in labor cost, but on the whole labor will remain where it is. We are going to be faced with high labor costs and we might as well face the situation and endeavor to promote the friendliest feelings between employer and employe and do everything possible to increase labor efficiency.

IOWA CONTRACTORS ARE CALLED TO GREATER ACTIVITY.

Weekly Bulletin to Members of State Association Contains Hint for All Dealers That There Is Much Spring Business Ahead.

Are we brooding over conditions as they are thought to be or are they real. The electrical papers carry the glad tiding that conditions are improving in the electrical field all over the country. Let's analyze ourselves. Are we still thinking of conditions as they were a month or so ago or are we thinking of conditions as they are today? Let's take an optimistic viewpoint of the situation.

Let's shake off the gloom of winter and war and take a new start. Spring is surely here. We should be interesting our customers with spring improvements. Let's get some plan of getting more business. Don't think there is no business, for that kind of thinking produces no business.

You can't do it alone. Hold a welfare meeting in your town. Get all of the contractors together. Hold a real welfare meeting. Don't quibble over things which have happened in the past. Invite your utility management to be present. Don't nag them about their past policies. Find out now what they are willing to do. Take a look forward, not backward. Have your utilities furnish you with a list of unwired properties on their existing lines.

Advertise. Combine with your utility in getting the people in your town to thinking about spring improvements—new electrical things in the home; more comforts from electricity at a low cost. Tell them in an attractive advertisement,

in dollars and cents, what it will cost per week or day to use devices like washing machines, toasters, vacuum cleaners and other popular devices—not in watts, but in dollars and cents. Speak to them in a language that they can understand. Show them the small amount of cost of running devices. Many people do not buy for fear of increasing their light bill, but when they come to know the small cost they will buy.

We all need help. Your association is trying to help you. Tell us what we can do; we are anxious to do it.

Some contractors are pledging $120 per year outside of their regular dues to carry on the work of the association more aggressively. Let's all put a shoulder to the wheel and put Iowa over big. We can't all be catchers; some must pitch. Let's be a pitcher now. There is much to be done.—G. W. Hill, Special Representative, Iowa Section, Association of Contractors and Dealers.

TELLING CUSTOMER WHEN REPAIRS WILL NOT PAY.

Even when the electrical man's object is real service to his customer, he occasionally runs up against knotty problems that may mean the loss of that same customer. Such is the case when a repair job is brought to him, and he honestly believes that the appliance or object to be repaired is so far gone that the repair wouldn't pay, says *Volume and Velocity*. The dealer in this case may well follow the example of a contractor who specializes on automobile charging in a small New York town. He frankly tells customers when repair jobs won't pay. Here is a letter he recently sent out to his patrons:

"Every once in a while we lose money by telling a customer that his battery is so far gone that repair wouldn't pay.

"It isn't because we couldn't repair it—we can repair almost anything. Bring us a pair of handles and we'd put a battery between 'em if you insisted.

"But our first responsibility is to save you money, and we can't do that by pulling a battery back from the edge of the grave and rebuilding it for you.

"We'll be perfectly frank with you about what it pays to repair and what it doesn't."

PRESENT APPLIANCE TRADE CONDITIONS ENCOURAGING.

Due to the fact that there has been much inflation in prices during the past 2 yrs. in general commodities, the fall in these prices the last few months has been much more rapid than necessary, with the result that buyers have held off, notwithstanding the fact that the statistical records show that there is an oversupply in only two commodities, according to C. E. Smock, advertising manager, Eureka Vacuum Cleaner Co. It is reasonably sure, therefore, that the retail merchants are cleaning out their shelves, and just as soon as this is accomplished this stagnation should be replaced by a period of active buying, because actual consumption has not diminished to a very great extent.

In the electric appliance field this fall in commodity prices has had a certain potent effect to the extent of slowing down dealer purchases somewhat and many dealers made purchases rather cautiously, supplying only their necessary needs and letting the future take care of itself. It is only a question of time—possibly 6 wks. or 2 mo.—until the hundreds of dealers who have exhausted their stocks must re-order to meet the consumer demand, which will start a business activity that will be healthy, normal and of a lasting nature.

There is no question whatever that the next few years will see the greatest activity ever known in electrical appliances. Women everywhere are sold on the idea of electrical housekeeping and it is just a question of how soon they are financially able to establish their home on this basis. With times and conditions back to normal those electric appliances offered and sold at reasonable prices to the consumer, and at a fair margin of profit to the dealer, are sure to enjoy popularity which will far surpass in volume and continuity all previous periods. Therefore, the quicker we all get back to normal, both as to conditions and frame of mind, the sooner will the new era of prosperity be with us.

ELECTRIC RANGES IN APARTMENTS.

The new Wooley apartments recently erected at Pocatello, Idaho, by Dr. H. S. Wooley, are each equipped with a semi-automatic electric range. Each of the 44 apartments containing these ranges is strictly modern and has its own sun-parlor. The energy for these ranges is furnished by the Idaho Power Co., and much satisfaction has been evidenced by the tenants at being able to cook the electric way.

NAMES OF SATISFIED CUSTOMERS IN SHOW WINDOW.

In demonstrating electrical appliances it has been found that a good practice is to place a card in the window bearing the names and addresses of several owners of these appliances. This is practically inviting the prospective buyer to call on any or all of these people with a view to satisfying herself as to the merits of these appliances. It inspires confidence in the product. Another good way would be to have a separate card of each name, using several different colors of ink, and putting a different card in the window each day. This, while taking a little more time and labor, has the added advantage of being more original, and arrests the attention of the passer-by. This method will have the effect of making those who pass the window pay more attention to the names and addresses when they are thus presented one at a time. In case any customer should be likely to object to this publicity, it might be well to get in touch with them and obtain their consent to use their names for this purpose.

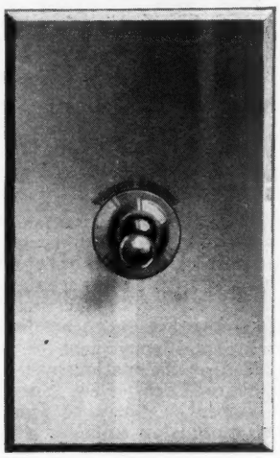
The superintendent of rural telephones of the province of Saskatchewan, Canada, states that in spite of construction difficulties approximately 4800 pole-miles will be added to the rural telephone system of the province during the present year. This is approximately the same amount as was added during 1919.

APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

Flip Switch for Lighting-Circuit Switches.

The Western Electric flip switch is designed to meet the demand for character in lighting-circuit switches. The device has a lever that may be flipped up or down, turning the lights on or off, as required. The action is a positive make and break of contact, insuring long life to all moving parts. The lever of the flip switch is up when the lights are on



Western Electric Flip Switch.

and down when the lights are off. This switch is therefore self-indicating. Flip switches are built with art plates that harmonize with the hardware and general scheme of decoration. Flip switches are built with single, gang and tandem plates. In addition, there is the lock-type switch for installation where it is desirable to keep unauthorized persons from turning the lights on or off. The Western Electric Co. also makes a radium-illuminated switch, the end of the flip lever being designed to hold the radium material which is protected by a glass brilliant the size of a 2-carat diamond. The glow of the radium at night eliminates fumbling and the soiling of wall paper or decorations. The switch is furnished with any standard plate.

Industrial Type "Hevi-Duty" Electric Furnaces.

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed exclusive sales agent in the United States, its possessions, and Canada for the line of industrial type "Hevi-Duty" electric furnaces, manufactured by the Electric Heating Apparatus Co., 123 Sussex avenue, Newark, N. J. The standard heavy-duty industrial furnaces include 12 different sizes with inside dimensions ranging from 18 by 24 by 13.5 ins. up to 32 by 72 by 16 ins., and in capacity from 22 to 80 kw. Either automatic or non-automatic temperature control is supplied. This line will be extended as developments warrant. Special heavy duty industrial furnaces of approved designs will be built in almost any size and capacities, and for temperatures up to 2000 deg. F.

These furnaces have established records for quick heating and uniformity of temperature throughout the heating chamber. This is made possible by the method of heating used, the heating elements completely surrounding the heating chamber, sides, top and bottom. Some of the more notable installations of the industrial type "Hevi-Duty" furnaces include the following: Scovil Manufacturing Co., Waterbury, Conn., employed for brass annealing; General Optical Co., Mt. Vernon, N. Y., employed for fusing bifocal lenses; Auto Strap Safety Razor Co., New York City, employed for tempering razor blade strips; Standard Steel Spring Co., Coraopolis, employed for tempering springs.

A New Application for Flood Lighting.

Recently the engineering department of the National X-Ray Reflector Co., Chicago, received the following letter from a man living in Baltimore: "I live in the suburbs and would like a spot or floodlight which I could throw at various points within 100 ft. of the house and into the tops of surrounding trees, where during certain weeks of the year blackbirds roost in annoying numbers." The X-Ray engineers told him that X-Ray No. 51-E projector would chase them.

Four-Lamp Fixture Designed for Small Living Rooms.

In its new catalog the Chas. Polacheck & Bro. Co., Milwaukee, shows its W-169 lighting fixture, illustration of which is depicted herewith. This fixture provides for four lamps and is made in old gold and polychrome finish. The spread overall is 15.5 in., the regular length being 28 in. This unit, which is an all-cast piece, is designed for a small living room.

Lighting Fixture for Small Living Room.

New Series of All-Brass Lighting Fixtures.

The "1100" line is one of the new series of all-brass fixtures manufactured by the Dallas Brass & Copper Co., 820 Orleans street, Chicago. This type is designed especially for the decoration and illumination of the modern home. The metal parts of the fixtures are made of special brass, and the fixtures can be supplied in plated finishes, such as Egyptian bronze and gold, russet bronze and gold, Flemish silver, Flemish and other plated finishes. They can also be had in various special sprayed finishes, such as tusk ivory and gold, dark ivory and other various sprayed finishes, as may be desired.

Ornamental Fixture for Home Lighting.

Octagon Outlet Box for Use in Concrete Buildings.

In order to meet the special needs of reinforced concrete work, the Adapti Co. of Cleveland has brought out a new stamped-steel octagon outlet box for such construction, offering features of more than usual interest. The octagon shape is of real value, offering a flat surface for locknut and bushing. The removable back is held in place by screws, a projecting lip being provided to take these screws and also close the keyhole slots against leaking concrete.

The box is nailed to the forms through projecting ears which are held in place by cover screws. Instead of trimming the nails after the forms are taken down, as in the usual box, the Adapti octagonal box leaves both the nails and projecting ears exposed so that they may be easily removed by loosening the cover screws. When an extra-deep box is required two or more boxes can be

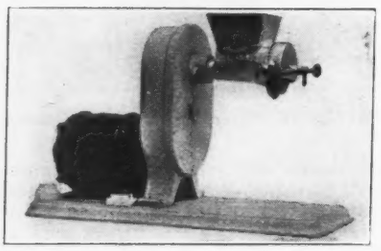
used to make one deep unit. The Adapti octagonal box is made 2, 3, and 4 ins. deep. Both sets of lips being tapped on 3.5-in. centers makes it a simple matter to assemble these boxes to any required depth to meet any con-

Outlet Box Designed for Use in Connection With Concrete Construction.

struction need without the addition of extension rings. Boxes are made for 0.5, 0.75 and 1-in. knockouts in any combination of outlets. This new unit is said to be coming into very general and satisfactory use.

Mill With Interchangeable Grinding and Mixing Units.

Heretofore the grinding and mixing of all small grains such as corn, oats, cornmeal and wheat, had to be done

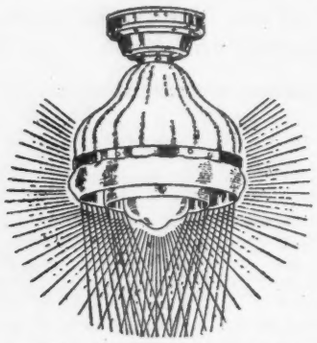


Model F-4 Mixer and Grinder.

in two separate machines, but now the model F-4 "Quaker City" grinding mill, made by the A. W. Straub Co., 3737 Filbert street, Philadelphia, permits the two operations being done in the one machine by exchanging the grinding and mixing units. This machine is electrically equipped, has only one shaft and the two units work from one position. This feature tends to speed up the mixing and enables the attachment being cleaned more easily and quickly.

Lighting Fixture Provided With Diffusing Glassware.

The National Diffused Light Manufacturing Co., 136 West Lake street, Chicago, is placing on the market illuminating units for use in offices, stores, theaters, lecture halls, hospitals, churches, factories, photographers and dentists' offices, residences, banks, hotels, street and railroad cars, etc. Two of these units are illustrated, one showing the direction of light deflection by the diffused lighting system, and the other a suspension fixture. The manufacturer claims that this type of unit gives uniform illumination over a great area with the minimum consumption of electrical



Showing Direction of Light Deflection by Diffused Lighting System.

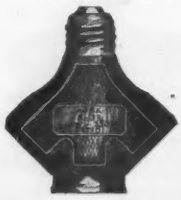
energy, the diffusers being specially constructed to prevent annoying glare. The light is comfortable and harmless to the eye, owing to the daylight quality—a

"National" Diffused Illuminating Unit.

non-irritating white light. With this unit 200-watt type C lamps can be used to advantage.

New Types of "Ajax" Double and Triple Socket Plugs.

The Ajax Electric Specialty Co., St. Louis, has recently placed on the mar-



"Ajax" Triple Socket Plug.

ket some new types of its No. 22 double-socket and No. 33 triple-socket plugs. The company states that "difficulty has been experienced in our former method of molding directly on to the frames. In these new types this difficulty is eliminated by using separate husks molded of high-heat-resisting compound." The "Ajax" plural-socket plug is made in one piece, allowing the lamp to remain in the position intended, and permitting the use of ordinary stock shade-holders. This places the side socket at an angle of 45 deg., preventing the appliance connection from in-

No. 22 Double Socket Plug.

terfering with the shade-holder or the shade on the lower socket.

Instrument Used to Determine Condition of Battery.

A storage-battery cell tester, said to be accurate and convenient to use, is being placed on the market by the Metric Appliance Corp., New York City. The instrument, as may be seen from the illustration, is an ammeter with self-

"MAC" Storage-Cell Tester.

contained terminals and a handle. The test is made by pressing the terminals of the instrument onto the tops of the terminals of each cell in the battery and reading the indication of the needle.

The entire device is of particularly simple construction, being designed with the fewest possible parts with an instrument of this type. A one-piece aluminum punching serves as the coil, dial, terminals and armature mounting and holds the glass cover in position. The case is made of rubber composition.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Mallory Diesel Electric Corp., Dover, Del., has filed notice of increase in its capital stock from $100,000 to $250,000.

Appleton Electric Co., Chicago, manufacturer of conduit fittings, is now located at 1701 Wellington avenue.

Fuller Storage Battery Co., operating works at Hartford and New Haven, Conn., and Providence, R. I., whose affairs recently have been in litigation, has been acquired by Sherman A. Fuller, founder of the company, and associates. The new interests will continue the operation of the business.

M. W. Kellogg Co., 117 West Side avenue, Jersey City, N. J., manufacturer of power plant equipment, has filed plans for the erection of a 1-story addition to cost about $25,000.

Lowenstein Radio Co., Newark, N. J., manufacturer of radio apparatus, has disposed of its local plant on Spring street to the Spring Street Realty Co., consisting of a 2-story factory, with power house, 25 by 120 ft.

Held Electric Co., Utica, N. Y., manufacturer of electrical specialties, has increased its capital stock from $15,000 to $30,000.

Columbia Lamp Works, New York City, has leased property at 794 Tenth avenue for a new local establishment.

General Electric Co. has construction under way on a 1-story addition to its West Lynn (Mass.) plant, 177 by 220 ft. The factory will be an extension to building No. 63.

Keystone Hair Insulator Co., 1243 Spring Garden street, Pittsburgh, manufacturer of electrical equipment, plans to construct a 3-story plant, 70 by 100 ft., adjoining its present works.

Radio Corp., of South America, Inc., New York City, has filed notice of change of name to the South American Radio Corporation, at the same time increasing its capital stock from $11,000,000 to $20,000,000.

United Electric Products Co., New York City, has leased space at 22 West 17th street, for a new local establishment.

Automotive Electric Service Corp., 206 Amsterdam avenue, New York City, has filed notice of increase in its capital stock from $10,000 to $50,000 for expansion.

Electrograph Sign Co., New York City, has leased property at 374 East 141st street, for a new local establishment.

B. F. Sturtevant Co., Boston, manufacturer of fans, blowers, etc., sustained a loss of $50,000 by fire recently, one of the buildings at its Readville plant being destroyed.

Central Telephone & Electric Supply Co., St. Louis, of which F. D. Phillips is president, has announced the removal of its headquarters from 310 North 11th street to 2018 Locust street. The new home of the company is four stories in height and contains

New Home of Central Telephone & Electric Co., St. Louis.

40,000 sq. ft. of floor space, or more than twice the floor space of the old building. The new building is of brick and is equipped with a sprinkler system. The location is on the main east-and-west thoroughfare of St. Louis and gives the company a splendid opportunity for display publicity on its own property.

Rose Electric Co., New York City, electrical equipment and supplies, has filed notice of dissolution under state laws.

Cohn & Roth Electric Co., Hartford, Conn., manufacturer of electrical equipment, has increased its capital stock from $10,000 to $25,000.

Dudley Electric & Machine Co., Uniontown, Pa., manufacturer of electrical equipment, sustained a loss of $50,000 by fire recently, a portion of its plant on East Fayette street being destroyed.

Ritter Dental Manufacturing Co., Inc., Rochester, N. Y., has issued a catalog describing and illustrating its dental line of equipment, consisting of chairs, engines, lathes, distributing panels, air compressors, unit equipment, X-ray apparatus, etc. A separate booklet of 20 pages is devoted to the "Ritter Unit Equipment."

Dwight P. Robinson & Co., Inc., 125 East 46th street, New York City, engineer and contractor, has announced the recent opening of branch offices in the Dominion Express building, Montreal, Can., with Alexander C. Barker, vice-president, in charge. This company has already done extensive construction and engineering work in Canada for the Canadian Pacific Railway Co., Canadian Salt Co., Canadian Crocker-Wheeler Co., Dominion Government, Aetna Explosives Co., and the Grand Trunk Railway Co., and expects shortly to close some large contracts for additional undertakings.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued leaflet 1160-A, which illustrates and describes the features of its type CS squirrel-cage induction motors. These motors are constant speed, continuous rated from 2 to 200 hp., 2 and 3-phase, with 25, 40, 50 and 60-cycle, and 110, 220, 440, 550 and 2200 volts. In addition to the discussion on the motor and its parts, the type A auto starter and the type 815 motor-starting switch for 10-hp. motors and below are illustrated.

Lightolier Co., 569 Broadway New York City, has issued a 28-page booklet entitled the "Secret of Entrancing Light," which contains valuable information for planning the lighting of the home. The left-hand pages are devoted to a separate treatment of the different rooms, and each bears an illustrated description of the modern practice in lighting as given in the treatise of M. Luckiesh on "Lighting the Home." On the right-hand pages are pictured and described suitable "Lightolier" fixtures for the room illustrated on the left-hand page, and thus the recommended practice and suggested fixture face each other. The Lightolier Co. imprints this booklet with representing dealer's name and address for his distribution.

Cutler-Hammer Manufacturing Co., Milwaukee, has issued a 20-page booklet entitled "Increasing the Press Output," and known as publication 888, describing the C-H pre-set motor control for platen, cylinder, offset, sheet feed rotary and small web presses. Controllers and master switches for both alternating and direct-current circuits are shown. C-H pre-set press controllers are described as consisting of an automatic motor starter with a speed setting lever, which is pre-set for the speed desired. They may be mounted on the wall or a column out of the way of the pressman. Control is obtained from one or more push-button stations which are mounted at various points convenient to the press operator. Pushing a button automatically brings the motor up to the speed for which the controller is set and this speed may be varied by changing the speed-setting lever. The motor is stopped and the press is inched for make-ready by means of push buttons. The entire control of the press is at the operator's finger tips when standing on the running board. This control is also employed on other machines, including cloth-finishing presses, ribbon presses, paper-coating and waxing machines.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

EDWIN S. CARMAN has been elected president of the American Society of Mechanical Engineers to succeed Major Fred J. Miller.

GEORGE H. WILMARTH, manager of the Muskogee (Okla.) division of the Oklahoma Gas & Electric Co., has been elected president of the Muskogee Rotary Club.

EDWARD M. ORNITZ, formerly manager of the road forms department of the Blaw-Knox Co., Pittsburgh, is now assistant sales manager of the steel forms department.

B. F. THOMAS has resigned as mechanical engineer for the United Railways of St. Louis to become assistant superintendent of power for the Scullin Steel Co., St. Louis.

EZRA B. WHITMAN, Baltimore, has accepted an appointment as a member of the State Public Service Commission, succeeding James C. Legg, deceased. He will assume the position at once.

MARTIN J. YOCOM, for 21 yrs. secretary of the Pawling & Harnischfeger Co., Milwaukee, has retired from active participation in the company, and has been succeeded by Rene Von Schleinitz, assistant secretary.

H. SPALDING, Cleveland, gave an interesting address on plant lighting before a recent meeting of the safety division of the Pittsburgh Chamber of Commerce. He is a member of the National Electric Light Association.

A. B. BUSSMANN, who is president of the Bussmann Manufacturing Co., St. Louis, manufacturer of "Buss" fuses, is actively in charge of the financial end of the company as treasurer and credit man. When he is not writing collection letters he will probably

A. B. Bussmann.

be found on the golf links (weather permitting), or a volley ball court, or at home bouncing one of his three youngsters on his knee. To his intimate friends he is known as "Al," his first name being Aloysius.

C. H. MUELLER, formerly connected with the circuit-testing section of the Duquesne Light Co., Pittsburgh, has been placed in charge of the electrical testing division as superintendent.

THOMAS H. S. ANDREWS, formerly connected with the engineering staff of the J. G. White Engineering Corp., has become affiliated with the E. G. Long Co., 50 Church street, New York City, as secretary.

ROY BOOTH, superintendent of the Brantford (Can.) plant of the Robbins & Myers Co., Springfield, O., manufacturer of electric motors, generators and fans, visited the Springfield (O.) headquarters of the company recently.

LAMAR STILWELL, formerly of the purchasing department of the Robbins & Myers Co., Springfield, O., manufacturer of electric motors, generators and fans, has been transferred back to the main office from the Canadian plant of the company at Brantford.

OWEN A. JACKSON has resigned as chief engineer at the Harvard Square power station of the Boston Elevated railroad to accept a position as chief engineer of the Salem (Mass.) Electric Lighting Co., to succeed W. H. Barnard, who has been appointed plant supervisor.

BRENDAN JAMES MCCANN, formerly associated with George P. Kimmel, of Washington, and with Brown, Boettcher & Dienner, of Chicago, has announced that he will continue the practice of law relating to patents, trade marks, copyrights and corporations at 1336 Monadnock block, Chicago.

E. M. HERR, president of the Westinghouse Electric & Manufacturing Co., spoke on "Modern Business in General," at a recent dinner given by the Springfield (Mass.) Chamber of Commerce. Mr. Herr's talk, which was illustrated by motion pictures and stereopticon views, had special reference to the Springfield works of the Westinghouse company.

ROBERT P. SANBORN has been appointed manager of the traction department of the Edison Storage Battery Co., with headquarters at the factory and main office in Orange, N. J. He is well known to the industry through a connection of several years in the power and mining department of the General Electric Co., Erie (Pa.) works.

W. D'A. RYAN, director of the illuminating engineering laboratory of the General Electric Co., gave a talk on "Ancient and Modern Lighting" before the Electric Club of Chicago recently. With the aid of slides Mr. Ryan showed ancient and modern methods of lighting. His slides depicting the wonderful lighting at the Panama Exposition were especially interesting.

EARL C. JOHNSTON, who is in charge of the St. Louis territory of the Bussmann Manufacturing Co., manufacturer of "Buss" fuses, is a native of Columbus, O. He was formerly purchasing agent for the East St. Louis & Suburban Railway Co. When Mr. Johnston is not too busy pushing the sales of "Buss" fuses in his territory he en-

E. C. Johnston.

joys a game of golf, which is one of his favorite pastimes during the outdoor season.

OBITUARY.

LOUIS GENDRON died in Worcester, Mass., last month, aged 71 yrs. He was the last of the original directors of the Warren Steam Pump Co. of Warren, Mass.

CHARLES AINSWORTH SPOFFORD died at Chandler, Ariz., recently. He was 68 yrs. old, and was one of the organizers of the New York Edison Co. He was a son of the late Ainsworth Hand Spofford, formerly librarian of Congress. Mr. Spofford went to London in 1900 as the representative of American interests in the electrification of the underground railway and shortly after his return to this country he retired from active business.

KURT R. STERNBERG, chief chemist of the Asbestos Shingle, Slate & Sheathing Co., Ambler, Pa., died Feb. 25. He was born in Bostock, Germany, Nov. 8, 1844, and at the age of 19 emigrated to the United States where after many years of varied experience he undertook the management of the Dickinson Manufacturing Co., Springfield, Mass. After an association with this firm extending over a period of 12 yrs., Mr. Sternberg resigned and took up the work of consulting chemist, specializing in molded electrical insulations, hot and cold pressings, and heat, mechanical, electrical, oil, acid and water resistance tests. In May, 1920, Mr. Sternberg assumed the position in the insulating department which he held at his death and the department had only just commenced operating in its newly-erected plant at West Ambler. He was affiliated with many electrical and fraternal orders and is survived by a widow, one daughter and three sons.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Portsmouth, N. H.—Electrical equipment will be installed by the Bureau of Yards and Docks, Washington, D. C., at its 2-story welding works, 30 by 53 ft., now in course of erection here.

Boston, Mass. — The John West Thread Co., 297 Congress street, will install considerable electrical equipment at its new 2-story plant at South Boston, estimated to cost $100,000. The Aberthaw Construction Co., Boston, is the building contractor.

Lawrence, Mass.—The Universal Tide Power Co., 420 Essex street, has filed notice of organization to operate a hydroelectric power plant. The company is headed by W. L. Bullock, J. A. Knowlton and C. E. Smith.

Three Rivers, Mass.—The Palmer Mills have awarded a contract to the McNally Building Co., Inc., 41 Concord street, Framingham, Mass., for the erection of a 1-story transformer station at its textile plant, 30 by 70 ft.

Hartford, Conn.—A 1-story power house will be constructed by the Lincoln Dairy Co., 52 Lincoln street, in connection with its new dairy plant in this section.

Hartford, Conn.—The Board of Health and Board of Charities have had plans prepared for the erection of a 1-story and basement power house and laundry plant on Vine street, to cost about $77,000. The structure will be erected jointly. K. G. Lincoln is chairman of the joint committee.

Waterbury, Conn.—Electrical equipment will be installed in the proposed 1-story brass mill to be erected at the plant of the Scovill Manufacturing Co., Bridge street, estimated to cost $100,000.

Albany, N. Y.—F. C. Huyck & Sons, Third avenue, have awarded a contract to the Albany Southern Electric Co. for extensions and improvements in the power plant at their felt works to cost about $50,000.

Buffalo, N. Y.—The Niagara, Lockport & Ontario Power Co., Marine Bank building, is considering plans for the construction of a hydroelectric power plant on the Niagara river below Niagara Falls. Application for permission to utilize waters for the operation of the new plant has been made to the Federal Power Commission, Washington, D. C.

Buffalo, N. Y.—Electrical and mechanical equipment will be installed in the 1-story plant to be constructed by the Marine Laundry, 93 Elk street. C. E. Reynolds, 1691 Abbott road, is architect.

Campbell, N. Y.—J. W. Aullo, Campbell; J. R. Pulsifer, 60 South Clinton street, Rochester, N. Y., and associates, are considering the erection of a hydroelectric power plant in the vicinity of Campbell. Preliminary plans are under way. W. S. Lozie, Cutler building, Rochester, is electrical engineer for the project.

Jamestown, N. Y.—The Superintendent of Water and Lighting is taking bids for the construction of an addition to the city lighting plant on Steele street. L. P. Hapgood is superintendent in charge.

New York, N. Y.—The United Electric Light & Power Co., 130 East 15th street, is taking bids for the erection of a 3-story transformer and substation, 30 by 100 ft., at 115 West 97th street, to cost about $170,000.

New York, N. Y.—The Automatic Light & Power Co. has been formed by a consolidation of R. M. Owen & Co., and the Shore Acres Beach Corp., with a capital of $108,000, to operate a light and power system. The company is headed by R. M. Owen, L. Z. Worthington and H. B. Leary, 55 Broadway.

New York, N. Y.—The Department of Water Supply, Gas and Electricity, is considering a formal suggestion of Mayor Hylan covering the establishment of a municipal electric light and power system. It is proposed that the city utilize the surplus power at the generating stations of the local rapid transit company, with the establishment of necessary substations and underground conduit lines. The service would be used for street-lighting, and for light and power for the municipal buildings.

New York, N. Y.—The New York Central Railroad Co., Grand Central Terminal, has had plans prepared for the construction of a 1-story electric substation at Park avenue and 110th street, 50 by 57 ft., to cost about $22,000.

New York, N. Y.—The Remington Paper & Power Co. is arranging for an increase in its preferred stock from $800,000 to $2,500,000, the proceeds to be used in part for proposed expansion.

Rochester, N. Y.—Sibley, Lindsay & Curr, East Main street and Clinton avenue, are taking bids for the erection of a 1-story addition to the power plant used in connection with their local department store.

Boonton, N. J. — The Hanover Township Committee is arranging for the establishment of a new lighting district to include Hanover, Hanover Neck and vicinity. The initial installation will comprise about 142 street lamps, and this will be extended later.

Newark, N. J.—A recent fire destroyed the plant and equipment of the International Coal Products Co., 38 Shaw avenue, Irvington, with loss estimated at $100,000. It is understood that tentative plans are under way for rebuilding, and this will likely be on another site. The company is now operating a plant at South Clinchfield, Va.

Fords, N. J. — The Light Commissioners of Fords, Keasbey and Hopelawn are arranging for an appropriation of $6000 for street lighting work in this section.

Newark, N. J.—Electrical and mechanical equipment will be installed in the industrial school to be erected by the Board of Freeholders at the Overbrook Hospital, near Caldwell, N. J. Plans and specifications have been ordered prepared.

Trenton, N. J.—The City Commission has plans under way for the installation of a street-lighting system on South Montgomery street, to include an underground conduit system through the center of the thoroughfare, and improved, modern lighting units. Prof. C. E. Clewell, consulting engineer for the city on street lighting, will be in charge.

Allentown, Pa.—The Lighting Department is planning a number of changes in the street-lighting system, as well as extensions in different sections of the city. It is proposed to make a general redistribution for improvement; present 40-cp. lamps will be replaced with 100 and 250-cp. lamps, and improved lighting will be arranged on the Hanover boulevard and 19th street boulevard. City Engineer Bascom will be in charge. The Public Service Commission has approved a lighting contract made with the city and the Pennsylvania Power & Light Co.

Bethlehem, Pa.—Considerable electrical equipment will be installed in the 10-story hotel to be erected by the Bethlehem Hotel Corp., estimated to cost in excess of $500,000.

Glen Rock, Pa. — The Enterprise Furniture Co. is considering the erection of an addition to its power house.

Lancaster, Pa.—A new electric company, to be known as the Lancaster County Electric Light, Heat & Power Co., is being formed by utilities now operating at Martic, Drumore, Fulton, Coleraine, Little Britain and neighboring districts. Application for permission has been made to the Public Service Commission.

Philadelphia, Pa.—Electrical and mechanical equipment will be installed in the school to be established by the Philadelphia Mechanical and Electrical School in the building at Broad and Spring Garden streets. Property has been leased at this location for a term of years.

Philadelphia, Pa.—The state legislature, Harrisburg, is considering a bill providing for an appropriation of $350,000 for the construction of an electric power plant at the local Jew-

ish Hospital. The board of directors will be in charge.

Philadelphia, Pa.—The American Ice Co. has completed plans for the erection of an addition to its power house at Walnut lane and Belfield street. Improvements will be made in the present structure.

Philadelphia, Pa.—Considerable electrical equipment will be installed in the group of buildings to be erected at the Anna T. Jeanes Memorial Hospital, consisting of 1 and 2-story structures. Heacock & Hokanson, Bailey building, are architects.

Pittsburgh, Pa.—The West Penn Power Co., West Penn building, has tentative plans under way for the construction of the third generating unit at its electric power plant at Springdale, near Pittsburgh, comprising a 1-story structure, about 200 by 900 ft., estimated to cost close to $5,000,000 with machinery. Sanderson & Porter, 52 William street, New York City, are engineers for the company.

Watsontown, Pa.—The manufacturers of this city are investigating the practicability of erecting a power station to supply the local industrial plants and the borough with electric light. Address Ridgway Brick Co.

Aberdeen, Md.—Considerable electrical and mechanical equipment will be installed by the Ordnance Department of the War Department at the proposed new central arsenal to be located here at an estimated cost of $5,500,000.

Baltimore, Md.—The Public Improvement Commission is considering tentative plans for the construction of an electrically operated pumping plant for the city waterworks, to be located at Monebello, and used in connection with the increased water supply secured through the raising of the Gunpowder dam; this latter work is now under way. The new pumping plant is estimated to cost $870,000.

Baltimore, Md.—Considerable electrical and mechanical equipment will be installed in the proposed new milk pasteurizing and distributing plant to be erected by the Western Maryland Dairy, Inc., Linden avenue and Dolphin street, at a cost estimated at $1,000,000. Irvin D. Baxter is chairman of the board.

Baltimore, Md. — The Bethlehem Shipbuilding Corp., Sparrows Point is planning the installation of steam-turbine engines in four ore carriers to be constructed for its affiliated organization, the Ore Steamship Corp., instead of internal combustion engines as originally planned. The vessels will have a rating of 20,000 tons of ore each.

Riverdale, Md.—Following the refusal of the Potomac Electric Power Co., Washington, D. C., to install a system and furnish service here, the council has appointed a committee to draw up plans and specifications for a municipal electric lighting plant and distributing system.

Huntington, W. Va.—The Parsons Co., 418½ Tenth street, recently formed with a capital of $300,000, is planning the installation of electrical equipment and general mining machinery at its properties in the vicinity of Peach Creek. Bids will be asked late in May. A. F. Parsons is president and manager.

Elm City, N. C.—The city will issue $25,000 electric bonds. Address Clarence Winstead, town clerk.

Anderson, S. C.—The Centerville Electric Co., recently organized, is planning the construction of a transmission line, about 6 mi. in length. Theron S. Allen is secretary and treasurer.

Columbus, Ga. — The "white way" lamps on Broad street will be extended on the West side of 14th street. Address Chairman Hendricks of the special committee.

Ocella, Ga.—It is proposed to offer for sale $25,000 of water and light bonds. Address E. L. Caldwell.

Nocatee, Fla.—The Nocatee Ice & Power Co., recently organized, will operate a local electric light and power system. F. R. McConnell and H. T. Davis head the company.

Ocala, Fla.—The Ocklawaha Reclamation Farms, of which J. D. Young is president, has applied to the Federal Power Commission for a preliminary permit to develop power at the proposed U. S. Government lock and dam in the Ocklawaha river, Marion county, Florida, for public utility purposes.

South Jacksonville, Fla.—The city council has approved a bond issue of $190,000, a portion of the fund to be used for the installation of additions to the electric light and power system.

NORTH CENTRAL STATES.

Ashtabula, O.—Bids will be received March 14 for the purchase of $500,000 electric light bonds. Address M. A. Taylor, city auditor.

Lima, O.—The City Council has provided for a bond issue of $180,000 for extensions to the boulevard lighting system. Address Service Director Elmer McClain.

Springfield, O. — Preparations are being made by the Bell Telephone Co. to erect an exchange building in South Spring street at an estimated cost of $400,000.

Wapakoneta, O.—An ordinance has passed the city council providing for an issue of $110,000 electric light bonds. Address city clerk.

Benton Harbor, Mich.—The chamber of commerce will recommend to the city council a new curb-lighting system.

Lansing, Mich.—Plans have been prepared by Woodwill & Rosler, 501 Fifth avenue, New York City, for the erection of a $5,000,000 power house. Address J. A. Parsons, city clerk.

Union City, Mich.—Bonds to the amount of $80,000 will be voted on shortly for the development of a water power system west of town. Address city clerk.

Whitehall, Mich.—At the spring election the question of issuing $33,000 light and water bonds will be submitted to a vote. Address town clerk.

Fort Wayne, Ind.—A county farm and power plant will be erected here at an estimated cost of $400,000. Address Angus McCoy, county auditor.

Mishawaka, Ind.—J. W. Bard and C. W. Cole, South Bend, Ind., plan to establish an electrically operated woodworking plant at this place.

Alton, Ill.—Additional lamps are proposed for Upper Alton. Address city clerk.

Peoria, Ill.—Plans are under way for installing an ornamental street-lighting system throughout the city. Address Henry J. Monahan, commissioner of public works.

Springfield, Ill.—The Springfield Citizens Co. has been organized with a capital of $5000 for the purpose of aiding the city to take over the heating and electric property of the Utilities Co. A. L. Hereford is president of the new company.

Jefferson, Wis.—It is planned to issue $22,000, 5.5% bonds to improve the light and water plant at this place.

Merrill, Wis.—A lighting plant will be installed here at a cost of $30,000. Address Harry R. Allen, city clerk.

Whitehall, Wis.—Plans have been prepared by A. D. Conover, Tenney block, Madison, Wis., for power house and various equipment for the county asylum. The estimated cost of the work is $12,000. Address P. K. Risberg, county auditor.

Duluth, Minn.—The Northern States Electric Construction Co. will build transmission lines and install a light and power system. Address R. H. Hilgedick, 117 East Second street, Duluth.

Fairmont, Minn.—The Lake Shore Electric Co. has been incorporated with a capital of $10,000. Address H. C. Stadem.

St. Cloud, Minn. — The city will build an electric light and power plant. Address L. B. Pattison.

Barnes City, Ia. — The Williams Electric Co. has been incorporated with a capital of $20,000 to furnish electric light and power to the city. Address Fred Williams, president.

Boone, Ia.—The Iowa Railway & Light Co. will make improvements and repairs on its properties in this city to the amount of $64,030 during the year. Address F. W. Linsbaugh, manager.

Cape Girardeau, Mo.—Work on the transmission line of the Missouri Public Utilities Co. between this city and East Prairie has been completed. It covers 50 mi. and carries electrical energy to 11 towns.

Wheaton, Mo.—The Wheaton Light, Ice & Cold Storage Co. has been organized with a capital of $40,000 to install and operate a local light and power system. W. A. Davidson heads the company.

Hillsboro, Kan. — Bonds to the amount of $60,000 have been voted for the expansion of the municipal lighting plant.

Beatrice, Neb.—The Beatrice Power Co. is considering plans for the financing the coming and pushing the construction work on the Barneston project. Address F. D. Kees.

Junction City, Kan. — The United Light & Power Co., with headquarters in Abilene, Kan., has completed plans

for the extensions of its lines down into the oil district, and the towns of Florence and Peabody will in a short time be on direct lines and receive the service of that company. Address G. B. Hughes, Junction City.

Broken Bow, Neb.—A special election will be held soon to vote on the question of issuing $50,000 bonds for increasing the capacity and efficiency of the municipal lighting plant.

Fairbury, Neb.—The city is installing one 550-kw. G. E. generator, connected to a 16 by 32 by 36-in. cross-compound condensing Corliss engine, Murray Iron Works Co., Burlington, Ia., builder. It is also planned to build 23 mi. of transmission line to connect several small towns. Last year the city connected 10 mi. of 3-phase, 60-cycle, 13,200-volt line to a brick yard with a connected load of 301 hp. Address G. D. Myers, water, light and sewer commissioner, Fairbury.

Canastota, S. D.—An election will be held shortly to vote on the question of issuing bonds for an electric light plant. Address city clerk.

Noonan, N. D.—An electric light and power plant will be erected at the mines near here to supply Noonan, Crosby and Ambrose with electrical energy. Address city clerk.

Velva, N. D.—Plans are being prepared for building an electric generating plant. Address J. W. Bice, general manager of the Velva Coal Products Co.

SOUTH CENTRAL STATES.

Bellevue, Ky.—Bids will be received March 24 for the franchise right of entering in and upon the streets, alleys, public ways and places of the city for the purpose of constructing such poles, wires, brackets, supports, etc., for furnishing electrical energy. Address LeRoy Hindman, city clerk.

Cherokee, Okla.—The city has voted $60,000 to increase the lighting plant and fire equipment. Address city clerk.

Marietta, Okla. — The Marietta lighting plant has been acquired by new interests headed by F. A. Price and Joseph Curtis, both of Gainesville, Tex. The new owners are planning extensions and improvements at a later date to cost about $20,000.

Mountain View, Okla. — The Borough Council has plans under way for the construction of an electric-lighting plant to cost about $30,000. A transmission system will also be constructed. Bids for the work, including equipment will be asked early in March. V. V. Long, 1300 Colcord building, Oklahoma City, Okla., is engineer for the work.

WESTERN STATES.

Colorado Springs, Colo.—The West Side Community Club has petitioned the city council for ornamental lamps on Colorado avenue.

Boise, Idaho.—Application has been made by the city to the Federal Power Commission at Washington, D. C., for permission to erect a 75-ft. dam on the north fork of the Payette river. This dam would store 1150-acre ft. of water and would develop about 12,000 hp. for municipal use. The Elmore Copper Co. also filed application for permission to build a dam 50 to 90 ft. in the Boise river.

Ogden, Utah—An election will be held March 26 to vote on the question of issuing $2,025,000 bonds for an electric-lighting system.

Ogden, Utah—Improvements totaling nearly $100,000 will be made in this city by the Mountain States Telephone & Telegraph Co. Address D. R. Smith, manager.

Hyak, Wash.—E. N. Tunin, Keechelus Inn, has applied to the Federal Power Commission for a license to construct a pipe line and small power house in Wolf creek at Lake Keechelus, Wash., for hotel lighting purposes.

Kelso, Wash.—The Long-Bell Lumber Co. plans to construct an electrically operated lumber mill.

Fresno, Cal.—The San Joaquin Light & Power Corp. has applied to the Federal Power Commission for a license to reconstruct and enlarge its present plant in the Kern river, 12 mi. northeast of Bakersfield, Cal., consisting of dam, reservoir, conduit, power house and transmission lines for public utility purposes. Also for license covering a comprehensive scheme of power development on the north and west forks of the Kings river in Fresno county. This project is located just below the applicant's project on the headquarters of the north fork of Kings river.

Los Angeles, Cal.—The Southern California Edison Co., Edison building, has applied to the Federal Power Commission for a license to construct 12 mi. of transmission line in the Sequoia National Forest, Kern and Tulare counties, Cal., for public utility purposes.

Los Angeles, Cal.—Marcus Pluth, 424 Wilcox building, has applied to the Federal Power Commission for a license to construct two diversion dams in the north and south forks of the Whitewater river, 7.5 mi. of conduit, power house on upper Whitewater river, and 9-mi. transmission line.

Los Angeles, Cal.—Escondido Mutual Water Co., H. Hawgood, Hellman building, has applied to the Federal Power Commission for a license covering a constructed power poject consisting of the following works: A diversion conduit 14.5 mi. long, taking water from San Luis Rey river into Bear Valley creek; a storage dam and reservoir in Bear Valley, two conduits, two power houses and transmission line, near Escondido in San Diego county, Cal., for public utility purposes.

Los Angeles, Cal.—Harrison Albright and Susie Bemust Albright, Laughlin building, have applied to the Federal Power Commission for a license to construct nine small diversion dams, a large dam and storage reservoir in Big Morongo valley, a similar dam and reservoir in Little Morongo valley, five conduits, two power houses and a transmission line in San Bernardino and Riverside counties, on Tahquitz creek, Snow creek, Whitewater and Mission rivers and Little Morongo creek., Cal., for public utility purposes.

INCORPORATIONS

Chicago, Ill.—Chicago Radio Apparatus Co. Capital $15,000. To manufacture radio apparatus, etc. Incorporators: C. C. Klentz, Leonard L. Lyon, 508 South Dearborn street, and others.

Rockford, Ill.—Rockford Power Machinery Co. Capital $35,000. To manufacture electric rewinding machinery. Incorporators: Charles B. Joyce, Ray Brown and P. C. Brown.

Wakeman, O.—Wakeman & Butler Road Electric Co. Capital $30,000. J. M. Burk, C. G. Latterman, G. B. Blanden and others.

Chicago, Ill.—Cote Brothers Manufacturing Corp. Capital $60,000. To manufacture electrical devices, machinery, etc. Incorporators: Thomas F. Cote, Hubert N. Stronck and Elmer H. Greaves, 4670 West End avenue.

Detroit, Mich.—Detroit Radio Laboratories, Inc. Capital $50,000. To manufacture wireless equipment for telegraph and telephone service. Incorporators: Irvin G. Dietterich, 3663 Pulford avenue; Arthur L. Smith and others.

Los Angeles, Cal.—La Electric & Fixture Works, 1910 South Main street. To manufacture electric fixtures, etc. Capitola La Touche heads the company.

Beamsville, Ont.—Monarch Industries, Ltd. Capital $300,000. To manufacture motors, carburetors, etc. Incorporators: Arthur E. Field-Marshall, James A. Hewett and others.

Dover, Del. — Sewickley Electric Manufacturing Co. Capital $500,000. To manufacture electrical recording meters and other electrical equipment. Incorporators: L. B. Phillips, Arthur J. Kingsbury and A. E. Silver.

Boston, Mass.—Star Lighting Fixture Co. Capital $5000. To manufacture electric lighting fixtures. Incorporators: S. Bell, H. H. Davis and Myer Machkowsky, 12 Pearl street.

Boston, Mass.—Electric Machinery Corp. Capital $100,000. To manufacture electrical machinery and parts. Incorporators: Howard D. Moore, Somerville, Mass.; Fred E. Crawford, Watertown, Mass.; and Lemuel W. Peters, Boston.

Pawtucket, R. I.—Eastern Electric Engineering Co., 98 Ridge avenue, has filed notice of organization to operate as an electrical engineer. James E. Brophy is head.

Poughkeepsie, N. Y.—Storage Battery Parts & Equipment Co. Capital $50,000. To manufacture storage batteries and other electrical equipment. Incorporators: H. Eggleston, J. W. Betts and W. S. Lent.

Brooklyn, N. Y. — Reddock-Simon Co. Capital $10,000. To manufacture electrical supplies. Incorporators: I. and R. Simon, M. D. Reddock, 1446 42d street.

East Orange, N. J.—W. L. Schoonover & Co., Inc. Capital $25,000. To engage as electrical engineers. Incorporators: Harry H. Picking, Charles O. Geyer and Gordon Grand.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Bond Offering of Public Service Co. of Northern Illinois.

An issue of $2,000,000 Public Service Co. of Northern Illinois 7.5% convertible gold debentures, due March 1, 1936, is being offered at 95 and interest, yielding about 8.10%, by Halsey, Stuart & Co. and A. B. Leach & Co., Chicago. The Public Service Co. of Northern Illinois operates in 15 counties in northeastern Illinois, having a combined population, according to the 1920 census, of 1,156,677, excluding the city of Chicago. The company supplies electric light and power, gas, water and heat. Consumers on Dec. 31, 1920, numbered 184,609, an increase of 44.8% since Dec. 31, 1915.

Offering of Des Moines Electric Co. Gold Notes.

Emery, Peck & Rockwood, Chicago, is offering an issue of $369,000 7.5% collateral convertible gold notes of the Des Moines Electric Co., dated May 1, 1920, and due May 1, 1925, at 98.5 and interest, yielding about 8%. The Des Moines Electric Co. supplies electric light and power in Des Moines, Ia., as well as a number of nearby towns, the total population served being about 150,000.

North American Co. and Subsidiaries.

The income account of the North American Co. and its subsidiaries for 1920, extracted from the report printed in last week's issue of Electrical Review, is as follows:

Gross earnings	$39,611,162
Operating expenses and taxes	30,110,350
Net income from operating	9,500,811
Other income	208,673
Total	9,709,484
Interest charges	3,459,304
Preferred dividends	525,905
Minority interest in Wisconsin group	327,986
Balance for depreciation, common dividends and surplus	5,396,288

Central Illinois Public Service Co.

The annual report of the Central Illinois Public Service Co. shows an increase of $561,406 in gross earnings in 1920 as compared with 1919, but because of increased operating costs and interest charges the net decreased $44,800. After charges and preferred dividends there was carried to surplus $60,103, bringing that item up to $339,735.

The income account for the year, with comparisons, follows:

	1920.	1919.
Gross earnings	$5,168,000	$4,606,594
Operating expense and taxes	3,842,637	3,447,011
Operating income	1,325,453	1,159,583
Other income	17,019	70,202
Net earnings	1,342,472	1,229,785
Interest	1,049,205	891,719
Net income	293,266	338,066
Preferred dividends	233,163	228,630
Total surplus	339,735	273,563

The balance sheet as of Dec. 31 last shows current assets of $1,763,675 and current liabilities of $2,594,841.

National Conduit & Cable Co.

The Guaranty Trust Co. of New York, 140 Broadway, New York City, has announced that a committee for the protection of the interests of stockholders of the National Conduit & Cable Co., Inc., was formed Feb. 16 at the request of a number of stockholders of the company. Formation of the committee follows the communication sent Feb. 14 to stockholders of the National Conduit and Cable Co., calling their attention to the fact that "unless the default in certain covenants of the first mortgage bond issue is remedied by March 15, 1921, the banking houses which originally purchased these bonds will ask the trustees to take immediate action." The committee is made up as follows: Chairman, M. P. Callaway, vice-president of the Guaranty Trust Co. of New York; Stephen C. Millett, of Millett, Roe and Hagen; Edward W. Harden, of J. B. Colgate and Co.; Hugh K. Prichitt, of Prichitt and Co., and secretary, Harold D. Bentley, investment trust officer of the Guaranty Trust Co. of New York.

Metropolitan Edison Co.

	1920.	1919
December operating revenues	$258,769.27	$215,746.21
Operating expenses, taxes and rentals	182,154.47	149,197.48
Operating income	$ 76,614.80	$ 66,548.73
Amount of maintenance expenditures included in above operating expenses	$ 32,162.26	$ 33,470.17

New Jersey Power & Light Co.

	1920.	1919.
December operating revenues	$48,133.29	$32,756.04
Operating expenses, taxes and rentals	34,411.81	26,749.25
Operating income	$13,721.49	$ 6,006.79
Amount of maintenance expenditures included in above operating expenses	$ 5,018.45	$ 2,558.25

Vermont Hydro-Electric Corp.

	1920.	1919.
December operating revenues	$43,775.23	$50,799.04
Operating expenses, taxes and rentals	45,293.05	32,753.43
Operating income	$ 1,517.82†	$18,045.61
Amount of maintenance expenditures included in above operating expenses	$ 7,767.64	$ 7,109.91

†Deficit.

Detroit Edison Co. and Subsidiaries.

	1921.	1920.
January gross	$2,135,951	$1,854,981
Net after taxes	573,995	473,886
Surplus after charges	317,613	304,130

Northern Ohio Electric Co. and Subsidiaries.

	1920.	1919.
December gross	$ 853,661	$ 922,440
Net earnings	213,941	306,673
Surplus after fixed charges	12,192	135,098
Deficit after preferred dividends	17,807	*105,098
Twelve months' gross	11,014,845	9,298,549
Net earnings	3,128,847	3,115,352
Surplus after fixed charges	833,418	1,096,680
Balance after preferred dividends	473,418	736,680

*Surplus.

Note—Decrease in December gross was due to closing industrial plants in territory served.

Pennsylvania Utilities System.

	1920.	1919.
December operating revenues	$254,202.61	$173,133.13
Operating expenses, taxes and rentals	194,077.31	125,948.83
Operating income	$ 60,125.30	$ 47,184.30
Amount of maintenance expenditures included in above operating expenses	$ 49,852.23	$ 12,452.92

Dividends.

	Term.	Rate.	Payable.
Am. Pub. Ser., pfd.	Q	$1.75	Apr. 1
Ark. Val. Ry. L. & P., pfd.	Q	$1.75	Mar. 15
Cons. Gas, E. L. & P.	Q	2%	Apr. 1
El Paso Electric	Q	$2.50	Mar. 15
Ill. Bell. Tel.	Q	$2.00	Mar. 31
Montana Power, com.	Q	$0.75	Apr. 1
Montana Power, pfd.	Q	$1.75	Apr. 1
No. Am. Co.	Q	$1.25	Apr. 1
Okla. Gas & Elec., pfd.	Q	$1.75	Mar. 15
Pacific T & T Co., pfd.	Q	$1.50	Apr. 15
Stand. Gas & Elec., pfd.	Q	$2.00	Mar. 15
Western Electric	Q	$2.50	Mar. 31

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Mar. 1.	Bid Mar. 8.
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	6	13	13
Adirondack Electric Power of Glens Falls, preferred	6	71	71
American Gas & Electric of New York, common	..	103	103
American Gas & Electric of New York, preferred	6	37	37
American Light & Traction of New York, common	..	110	108
American Light & Traction of New York, preferred	6	81	82
American Power & Light of New York, common	4	50	48
American Power & Light of New York, preferred	6	66	65
American Public Utilities of Grand Rapids, common	..	7	7
American Public Utilities of Grand Rapds, preferred	7	16	17
American Telephone & Telegraph of New York	..	99	102
American Water Works & Elec. of New York, common	..	3½	3½
American Water Works & Elec. of New York, particip	7	6½	6½
American Water Works & Elec. of New York, 1st peferred	..	39	39
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	23	23
Cities Service of New York, common	+extra	243	235
Cities Service of New York, preferred	6	67	67
Commonwealth Edison of Chicago	8	106	107
Comm. Power Railway & Light of Jackson, common	..	13½	13
Comm. Power, Railway & Light of Jackson, preferred	6	33½	33
Federal Light & Traction of New York, common	..	6½	6½
Federal Light & Traction of New York, preferred	..	42	41
Northern States Power of Chicago, common	..	48	48
Northern States Power of Chicago, preferred	ex.div.7	79	79
Pacific Gas & Electric of San Francisco, common	..	48	47
Public Service of Northern Illinois, Chicago, common	7	71	75
Public Service of Northern Illinois, Chicago, preferred	6	81	82
Standard Gas & Electric of Chicago, common	..	12	11⅛
Standard Gas & Electric of Chicago, preferred	8	35½	35
Tennessee Railway, Light & Power of Chattanooga, common	..	1½	1⅛
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5½	4¼
Western Power of San Francisco, common	..	24½	25
Western Union Telegraph of New York	..	88	87
Industrials—			
Electric Storage Battery of Philadelphia, common	4	98	98
General Electric of Schenectady	8	129	132
Westinghouse Electric & Mfg. of Pittsburgh, common	7	46	47